REMARKS

Applicant thanks the Examiner for the very thorough consideration given the present application.

Claims 1-20 are now present in this application. Claims 1, 10, 11, 13, 14 and 20 are independent.

Amendments have been made to the Title, Abstract of the Disclosure and specification, claims 1, 5, 7-9 and 11 have been amended. Claims 13-20 have been withdrawn from consideration but are still pending.

Reconsideration of this application, as amended, is respectfully requested.

Priority Under 35 U.S.C. §119

Applicant thanks the Examiner for acknowledging Applicant's claim for foreign priority under 35 U.S.C. §119, and receipt of the certified priority documents.

Election of Species Requirement

The Examiner has made the Election of Species Requirement final, and has withdrawn claims 13-20 from further consideration. Applicant retains the right to file these claims in a divisional patent application.

Title of the Invention

Applicant has amended the Title of the Invention in order to better reflect the subject matter claimed.

Abstract of the Disclosure

Applicant has amended the Abstract of the Disclosure in order to place it in better form.

Objection to the Specification and Specification Amendments

Applicant has amended the specification in order to correct minor typographical errors, and to place the specification in better form. They include replacing a number of instances of "RE" with – FE – in accordance with the kind suggestion by the Examiner to do this to overcome the objection to the specification regarding page 4, line 21 of the Application.

Claim Objections

The Examiner has objected to claims 1-7, 8, 9 and 11 because of several informalities. In order to overcome these objections, Applicant has amended claims 1, 5, 7-9 and 11 in order to correct the deficiencies pointed out by the Examiner. Reconsideration and withdrawal of this objection are respectfully requested.

Claim Amendments

Applicant has amended the claims in order to correct minor typographical errors, and to place the claims in better form. The claim amendments are not being made in response to any statutory requirement for patentability, and have not been narrowed in scope. Instead, the claims have been amended merely to recite the subject matter therein more clearly.

Rejection Under 35 U.S.C. §102

Claim 11 stands rejected under 35 U.S.C. §102(b) as being anticipated by U.S. Patent 5,502,698 to Mochizuki. This rejection is respectfully traversed.

A complete discussion of the Examiner's rejection is set forth in the Office Action, and is not being repeated here.

Claim 11 recites a combination of features including (1) an RF and servo error unit; (2) a servo control unit having a tilt error detecting and controlling block for receiving RF and focus error signals outputted from said RF and servo error producing unit to produce DC and AC values about the tilt initialization and an optical disk; and (3) a servo driving unit.

A prior art reference anticipates the subject of a claim when the reference discloses every feature of the claimed invention, either explicitly or inherently (see, In re Paulsen, 30 F.3d 1475, 1478, 1479, 31 USPQ2d 1671, 1675 (Fed. Cir. 1994), In re Spada, 911 F.2d 705, 708, 15 USPQ2d 1655, 1657 (Fed. Cir.

1990), Hazani v. Int'l Trade Comm'n, 126 F.3d 1473, 1477, 44 USPQ2d 1358, 1361 (Fed. Cir. 1997) and RCA Corp. v. Applied Digital Data Systems, Inc., 730 F.2d 1440, 1444, 221 USPQ 385, 388 (Fed. Cir. 1984).

It is well settled that the burden of establishing a *prima facie* case of anticipation resides with the Patent and Trademark Office (PTO). See, In re Piasecki, 745 F.2d 1468, 223 USPQ 785, 788 (Fed. Cir. 1984).

Applicant respectfully submits that the Office Action does not make out a *prima facie* case of anticipation of claim 11 by Mochizuki. For example, Mochizuki does not disclose a servo control unit having a tilt error detecting and controlling block for receiving RF and focus error signals outputted from said RF and servo error producing unit to produce DC and AC values about the tilt initialization and an optical disk, as recited in claim 11. Nor does the Office Action identify what part of Mochizuki's system comprises such a unit.

In fact, Mochizuki discloses in col. 11, starting in line 27, that a tilt error signal is detected by an error signal detection unit 108 and that a tilt correction mechanism is driven on the basis of the tilt error signal in a control mechanism driving circuit 109. These circuits are shown in Fig. 3. The only signal outputted from error signal detector 108 to drive circuit 109 is signal S108 and signal S108 is not disclosed as constituting "DC and AC values about the tilt initialization and an optical disk," as recited. In Mochizuki, the only DC signal mentioned is a scanning signal S13 which is generated by a separate unit, a

scanning signal generator 13 in Fig. 1 (or 113 in Fig. 3). No DC values are generated in Mochizuki based on receipt of received RF and focus error signals, as recited. In Mochizuki, scan signal generator 13 (or 113) receives a signal from motor 2, but does not receive an RF signal from the optical head 3 (or 103).

Accordingly, Applicant respectfully disagrees with the assertion in the Office Action that Mochizuki has a tilt error detecting and controlling block for receiving RF focus error signals outputted from said RF and servo error producing block to produce DC and AC values about the tile initialization and an optical disk.

Applicant also respectfully disagrees that col. 6, lines 45-61 and column 9, line 5 supports this allegation. In col. 6, lines 45-61, nothing at all is mentioned about production of DC values, for example. In col. 9, lines 5-13, Mochizuki merely discloses a "correcting operation" in order to compensate the focus error signal. The Office Action does not explain what Mochizuki's "correcting operation" has to do with the recited step of calculating a variation per track of the focus error to control the tilt using the variation, and Applicant is unable to understand that, either. In fact, Applicant respectfully submits that Mochizuki's "correcting operation" has nothing to do with the recited step of calculating a variation per track of the focus error to control the tilt using the variation.

Mochizuki sets a correction signal value to be supplied to an attitude control mechanism that may include a tilt control mechanism, a scanning signal

derived not from the optical head, but derived from the motor that drives the disk. Thus, Mochizuki does not include a tilt error detecting and controlling block for receiving RF and focus error signals outputted from said RF and servo error producing unit to produce DC and AC values about the tilt initialization and an optical disk, as recited in claim 11.

Accordingly, Mochizuki does not anticipate the claimed invention recited in claim 11. Reconsideration and withdrawal of this rejection are respectfully requested.

Rejections under 35 U.S.C. §103

Claims 1-4 and 12 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Mochizuki in view of U.S. Patent 6,256,271 to McLeod. This rejection is respectfully traversed.

A complete discussion of the Examiner's rejection is set forth in the Office Action, and is not being repeated here.

In rejecting claims under 35 USC §103, it is incumbent on the Examiner to establish a factual basis to support the legal conclusion of obviousness. See, In re Fine, 837 F.2d 1071, 1073, 5 USPQ2d 1596, 1598 (Fed. Cir. 1988). In so doing, the Examiner is expected to make the factual determinations set forth in Graham v. John Deere Co., 383 U.S. 1, 17, 148 USPQ 459, 467 (1966), and to provide a reason why one of ordinary skill in the pertinent art would

have been led to modify the prior art or to combine prior art references to arrive at the claimed invention.

Such reason must stem from some teaching, suggestion or implication in the prior art as a whole or knowledge generally available to one having ordinary skill in the art. Uniroyal Inc. v. F-Wiley Corp., 837 F.2d 1044, 1051, 5 USPQ2d 1434, 1438 (Fed. Cir. 1988), cert. denied, 488 U.S. 825 (1988); Ashland Oil, Inc. v. Delta Resins & Refractories, Inc., 776 F.2d 281, 293, 227 USPQ 657, 664 (Fed. Cir. 1985), cert. denied, 475 U.S. 1017 (1986); ACS Hospital Systems, Inc. v. Montefiore Hospital, 732 F.2d 1572, 1577, 221 USPQ 929, 933 (Fed. Cir. 1984). These showings by the Examiner are an essential part of complying with the burden of presenting a *prima facie* case of obviousness. These showings must be clear and particular, and broad conclusory statements about the teaching of multiple references, standing alone, are not "evidence." See In re Dembiczak, 175 F.3d 994 at 1000, 50 USPQ2d 1614 at 1617 (Fed. Cir. 1999). Note, In re Oetiker, 977 F.2d 1443, 1445, 24 USPQ2d 1443, 1444 (Fed. Cir. 1992). The mere fact that the prior art may be modified in the manner suggested by the Examiner does not make the modification obvious unless the prior art suggested the desirability of the modification. In re Fritch, 972 F.2d 1260, 1266, 23 USPQ2d 1780, 1783-84 (Fed. Cir. 1992). To establish *prima facie* obviousness of a claimed invention, all the claim limitations must be suggested or taught by the prior art. In re Royka, 490 F.2d 981, 180 USPQ

580 (CCPA 1970). All words in a claim must be considered in judging the patentability of that claim against the prior art. In re Wilson, 424 F.2d 1382, 1385, 165 USPQ 494, 496 (CCPA 1970).

Moreover, a factual inquiry whether to modify a reference must be based on objective evidence of record, not merely conclusory statements of the Examiner. See, In re Lee, 277 F.3d 1338, 1343, 61 USPQ2d 1430, 1433 (Fed. Cir. 2002).

The Office Action alleges that Mochizuki discloses "calculating a variation per track (abstract, lines 8-11, column 9, lines 1-3; column 4, lines 23-29) of the focus error to control tilt using the variation (abstract, lines 16-19; column 4, lines 35-39. . ."

Applicant respectfully disagrees with this allegation. Not one of the cited portions of Mochizuki in the previous sentence even mentions focus error or controlling tilt or calculating a variation in focus error or using focus error variation to control tilt.

Thus, Mochizuki does not disclose "calculating a variation per track of the focus error to control the tilt using the variation," as recited.

The Office Action then clearly admits that Mochizuki does not detect the maximum value and the minimum value of the focus error.

Applicant respectfully submits that this admission contradicts the previous assertion in the Office Action that Mochizuki calculates a variation per

track of the focus error. Without determining a maximum value and a minimum value, or at least two different focus values per track, it is not clear how Mochizuki can calculate a variation of the focus error per track. Furthermore, the assertion in the Office Action that Mochizuki discloses calculating a variation per track of the focus error in col. 9, lines 5-13 is not supported by the disclosure in that portion of Mochizuki. In col. 9, lines 5-13, Mochizuki merely discloses that the scanning signal S13 and its level is updated every one-revolution of the optical disc and discusses that a correction signal S11 is determined for automatic correction for the focus control.

To remedy the admitted deficiency in Mochizuki, the Office Action turns to McLeod and alleges that McLeod "discloses detecting the maximum and minimum values of a focus error to detect a normalized DC component (column 8, lines 36-54) in order to compensate for fluctuations."

The Office Action then concludes that it would be obvious to have added the step of detecting the maximum and minimum values of the focus error signal to detect a normalized DC component as suggested by McLeod "the motivation being to compensate for fluctuations, thereby obtaining accurate focusing."

Applicant disagrees with this conclusion and points out that the alleged motivation is based on a faulty basis.

In col. 8, lines 44-46, McLeod discloses normalizing the focus error signal (A-B) to the total strength (A+B) to compensate for fluctuations in laser strength,

whereas in col. 8, lines 47-54, McLeod discloses defining the maximum and minimum tolerable value limits of the focus error signal $D1 < (A-B)/(A+B) < D2$, where D1 is the minimum limit and D2 is the maximum limit, and when the normalized focus error signal (A-B) /(A+B) falls outside this range, the head is moved to bring it within this range, thus focusing on a particular layer.

Thus, McLeod discloses two different normalizations of a focus error signal, each used for different purposes. Moreover, the normalized focus error signal related to laser strength fluctuations is not the normalized focus error signal related to focusing on a layer, so the alleged motivation to "compensate for fluctuations" has nothing to do with the maximum and minimum values of the focus error signal.

Thus, the alleged motivation to modify Mochizuki in view of McLeod is improper.

Moreover, McLeod only discloses bringing the head within range when the normalized focus error signal (A-B) /(A+B) falls outside this range defined by D1 and D2, and contains no disclosure of tilt control or of use of the normalized focus error signal (A-B) /(A+B) with respect to tilt control.

So, even if McLeod's maximum and minimum values for focus error were applied to Mochizuki, one of ordinary skill in the art would only use them to "focus on a particular layer" as taught by McLeod.

Thus, even if these references were properly combined (and they are not properly combined), they would not result in, or render obvious, the claimed invention.

Additionally, as pointed out above, evidence of reasons why one of ordinary skill in the pertinent art would have been led to modify the prior art or to combine prior art references to arrive at the claimed invention must be clear and particular, and broad conclusory statements, such as "obtaining accurate focusing," standing alone, are not such "evidence." See In re Dembiczak, cited above.

Accordingly, the Office Action fails to make out a *prima facie* case of obviousness of claims 1-4 and 12.

Reconsideration and withdrawal of this rejection are respectfully requested.

Claims 5-7 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Mochizuki in view of McLeod and further in view of JP 2001-23213 to Kashiwabara.

This rejection is respectfully traversed. A complete discussion of the Examiner's rejection is set forth in the Office Action, and is not being repeated here.

The Mochizuki-McLeod reference combination is improper and does not result in, or render obvious, the invention recited in claim 1, from which claims

5-7 depend, for the reasons stated above. Moreover, Kashiwabara is not cited or applied to remedy the aforementioned deficiencies in Mochizuki or McLeod.

So, even if Kashiwabara were used to modify the Mochizuki-McLeod reference combination, that reference combination would not result in, or render obvious, the claimed invention.

Furthermore, Kashiwabara does not appear to disclose or suggest normalizing the variation per track of surface vibration to control tilt. In this regard, Applicant has attached a computerized English language translation of Kashiwabara from the Japanese Patent Office (JPO), the correctness of which is not guaranteed by the JPO or Applicant.

Accordingly, this rejection of claims 5-7 is improper and should be withdrawn.

Claim 8 stands rejected under 35 U.S.C. §103(a) as being unpatentable over Mochizuki in view of McLeod and Kashiwabara, and further in view of U.S. Patent 5,583,838 to Itoh. This rejection is respectfully traversed.

A complete discussion of the Examiner's rejection is set forth in the Office Action, and is not being repeated here.

The Mochizuki-McLeod-Kashiwabara reference combination is improper and does not result in, or render obvious, the invention recited in claim 5, from which claim 8 depends, for the reasons stated above. Moreover, Itoh is not cited

or applied to remedy the aforementioned deficiencies in Mochizuki or McLeod or Kashiwabara.

So, even if Itoh were used to modify the Mochizuki-McLeod-Kashiwabara reference combination, that combination of references would not result in, or render obvious, the claimed invention.

Accordingly, this rejection of claim 8 is improper and should be withdrawn.

Claim 9 stands rejected under 35 U.S.C. §103(a) as being unpatentable over Mochizuki in view of McLeod and Kashiwabara, and further in view of U.S. Patent 6,452,897 to Van Den Enden. This rejection is respectfully traversed.

A complete discussion of the Examiner's rejections is set forth in the Office Action, and is not being repeated here.

The Mochizuki-McLeod-Kashiwabara reference combination is improper and does not result in, or render obvious, the invention recited in claim 5, from which claim 9 depends, for the reasons stated above. Moreover, Van Den Enden is not cited or applied to remedy the aforementioned deficiencies in Mochizuki or McLeod or Kashiwabara.

So, even if Van Den Enden were used to modify the Mochizuki-McLeod-Kashiwabara reference combination, that combination of references would not result in, or render obvious, the claimed invention.

Claim 10 stands rejected under 35 U.S.C. §103(a) as being unpatentable over Mochizuki in view of McLeod and further in view of Kashiwabara.

This rejection is respectfully traversed. A complete discussion of the Examiner's rejection is set forth in the Office Action, and is not being repeated here.

Mochizuki's tilt error method is not disclosed in column 8, lines 56-62, as alleged in this rejection. Applicant cannot find Mochizuki's tilt error method disclosed in detail until one reaches col. 11, line 27, which is far beyond the referenced col. 8, lines 56-62. Moreover, Mochizuki does not disclose obtaining a focus error (FE) track at a point where an RF signal is a maximum value, as recited. In this regard, the referenced col. 10, lines 6-21 of Mochizuki discloses a correction value calculating unit that detects a maximum of a plurality of RF reproduction signals and determines a scanning signal corresponding to the maximum RF reproduction signal value. Nothing is mentioned in col. 10, lines 6-21, of obtaining a focus error track at a point where an RF signal is a maximum value. Additionally, while the referenced col. 4, lines 7-23 discloses that in an optical disc device, as a defocus amount, a tilt amount or an off-track amount is increased, the amplitude of the RF reproduction signal outputted from the optical head is reduced, the referenced disclosure fails to mention obtaining a focus error track, let alone a focus error track where an RF signal is a maximum value.

Thus, Mochizuki fails to disclose even the portion of the claimed invention that the Office Action alleges that it discloses.

The Office Action then turns to Kashiwabara which is said to disclose wobbling a tilt driving block at a certain frequency to control the tilt. Applicant respectfully disagrees with this speculative interpretation of Kashiwabara. All the Kashiwabara Abstract says is ". . . performing the tilt correction to the skewness generated by the face wobbling of and optical disk and suppressing the generation of jitter." This appears to Applicant to merely state that skewness generated by a wobbling disk face is corrected by Kashiwabara. It says nothing about wobbling a tilt driving block at a certain frequency to control the tilt.

Applicant went to the JPO website and downloaded a computer generated translation by the JPO, the accuracy of which is not guaranteed by the JPO or Applicant, to learn more about Kashiwabara. Applicant encloses this translation as Exhibit A. Applicant has reviewed Exhibit A and has been unable to find any disclosure or suggestion in Exhibit A that Kashiwabara discloses or suggests wobbling a tilt driving block at a certain frequency to control tilt.

Accordingly, even if it were proper to modify Mochizuki in view of Kashiwabara, which has not been demonstrated in the Office Action, the resulting reference combination would not meet or render obvious the claimed feature of "wobbling a tilt driving block at a certain frequency" as part of a tilt control method, as recited.

In fact, because any wobble in Kashiwabara's disk is to be removed, combining Kashiwabara with Mochizuki would teach away from wobbling a tilt driving block at a certain frequency to control tilt. Thus, the alleged motivation to combine Kashiwabara and Mochizuki is without any basis in those references.

Lastly, the Office Action turns to McLeod to teach normalizing a focusing error signal, referencing col. 8, lines 36-54, in order to compensate for fluctuations and, in view of this teaching, to add the normalizing step of McLeod to the method of Mochizuki to compensate for fluctuations and achieve accurate focusing.

As pointed out above, in col. 8, lines 44-46, McLeod discloses normalizing the focus error signal (A-B) to the total strength (A+B) to compensate for fluctuations in laser strength, whereas in col. 8, lines 47-54, McLeod discloses defining the maximum and minimum tolerable value limits of the focus error signal $D1 < (A-B)/(A+B) < D2$, where D1 is the minimum limit and D2 is the maximum limit, and when the normalized focus error signal $(A-B)/(A+B)$ falls outside this range, the head is moved to bring it within this range, thus focusing on a particular layer.

Thus, McLeod discloses two different normalizations of a focus error signal, each used for different purposes. Moreover, the normalized focus error signal related to laser strength fluctuations is not the normalized focus error signal related to focusing on a layer, so the alleged motivation to "compensate for

fluctuations" has nothing to do with the maximum and minimum values of the focus error signal.

Thus, the alleged motivation to modify Mochizuki in view of McLeod is improper.

Moreover, McLeod only discloses bringing the head within range when the normalized focus error signal (A-B) /(A+B) falls outside this range defined by D1 and D2, and contains no disclosure of tilt control or of use of the normalized focus error signal (A-B) /(A+B) with respect to tilt control.

So, even if McLeod's maximum and minimum values for focus error were applied to Mochizuki, one of ordinary skill in the art would only use them to "focus on a particular layer" as taught by McLeod.

Thus, even if these references were properly combined (and they are not properly combined), they would not result in, or render obvious, the claimed invention.

Accordingly, this rejection of claim 10 fails to make out a *prima facie* case of obviousness of the invention recited in claim 10 and should be withdrawn.

Additional Cited References

Since the remaining references cited by the Examiner have not been utilized to reject the claims, but have merely been cited to show the state of the art, no comment need be made with respect thereto.

Conclusion

All of the stated grounds of rejection have been properly traversed, accommodated, or rendered moot. Applicant therefore respectfully requests that the Examiner reconsider all presently outstanding rejections and that they be withdrawn. It is believed that a full and complete response has been made to the outstanding Office Action, and as such, the present application is in condition for allowance.

If the Examiner believes, for any reason, that personal communication will expedite prosecution of this application, the Examiner is invited to telephone Robert J. Webster, Registration No. 46,472, at (703) 205-8000, in the Washington, D.C. area.

Prompt and favorable consideration of this Amendment is respectfully requested.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37 C.F.R. §§ 1.16 or 1.17; particularly, extension of time fees.

Respectfully submitted,

BIRCH, STEWART, KOLASCH & BIRCH, LLP

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Attachment: Abstract of the Disclosure
Exhibit A (JPO Translation of Kashiwabara)

PATENT ABSTRACTS OF JAPAN

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(71)Applicant : MATSUSHITA ELECTRIC IND CO LTD

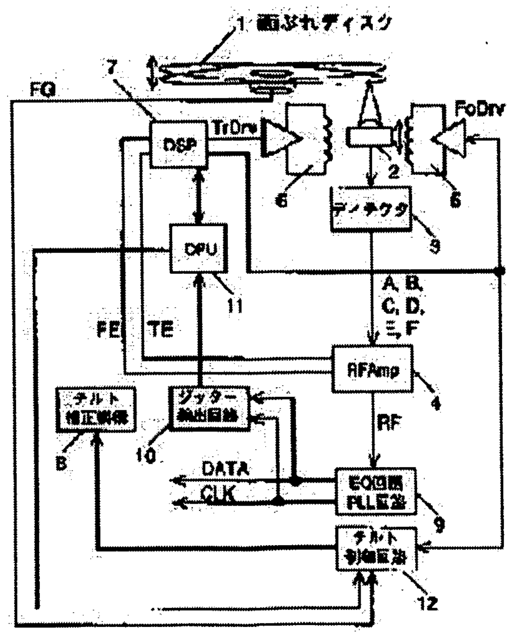
(72)Inventor : KASHIWABARA YOSHIRO

(54) TILT CONTROL METHOD AND OPTICAL DISK DEVICE

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a tilt control method and an optical disk device capable of stably reading out data by appropriately performing the tilt correction to the skewness generated by the face wobbling of an optical disk and suppressing the generation of jitter.

SOLUTION: A focus control signal changing in correspondence one to one to the change of tilt amount due to the face wobbling of the optical disk 1 is inputted to a tilt control circuit 12, and by means of performing the operational control of a tilt correction mechanism 8 by the tilt control circuit 12 based on the focus control signal, the correction corresponded to the tilt amount is surely performed, and the tilt is eliminated or the influence of the tilt is evaded, then the generation of the jitter is suppressed also for the face-wobbled optical disk 1 so that the data are stably read out.



LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of rejection]

EXHIBIT
A

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

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CLAIMS

[Claim(s)]
[Claim 1] The spindle motor made to rotate an optical disk and the optical pickup which receives the laser reflected light from an optical disk while irradiating a laser beam at an optical disk, The detector which changes into an electrical signal the lightwave signal reflected with said optical disk, The focal actuator which drives an optical pickup in the direction of a focus so that the focus of a laser beam may always suit to an optical disk signal side, The tracking actuator which drives an optical pickup in the direction of tracking so that a laser beam may always follow to the truck of the shape of the shape of a spiral of an optical disk, and a concentric circle, The servo processor which performs each servo control of the focal control to said focal actuator, and the tracking control to said tracking actuator based on the signal outputted from said detector, The tilt amendment device which amends the gap in said optical pickup of the laser reflected light from the optical disk at the time of tilt generating, The tilt control section which performs actuation control of the tilt amendment device concerned, It is the tilt control approach of the optical disk unit equipped with a jitter detection means to detect a jitter, from the data signal generated based on the signal for optical disk read-out among the electrical signals changed by said detector, and a synchronous clock. The focal control signal outputted from said servo processor to a focal actuator is inputted also into a tilt control section. The tilt control approach characterized by making the tilt adjustment based on the focal control signal with which the tilt control section concerned changes corresponding to the amount of tilts produced with an optical disk configuration carry out to said tilt amendment device.
[Claim 2] While said tilt control section outputs the signal acquired by carrying out output adjustment of the inputted focal control signal as a control signal for tilt adjustment of a radial direction to a tilt amendment device in the tilt control approach according to claim 1 Carry out output adjustment of said focal control signal, and the signal which shifted 90 degrees of phases and was acquired to the rotation location of an optical disk is outputted as a control signal for tilt adjustment of the tangential direction to a tilt amendment device. The tilt control approach characterized by making tilt adjustment of a radial direction and the tangential direction carry out to a tilt amendment device, respectively.
[Claim 3] In the tilt control approach according to claim 2 said focal actuator Have at least three or more drives to the direction of a focus, and it serves as a tilt amendment device. The control signal for tilt adjustment of the radial direction outputted from said tilt control section or the control signal for tilt adjustment of the tangential direction is inputted into said predetermined drive together with a focal control signal, respectively. The tilt control approach characterized by changing the generating driving force of each of said drive, making the tilt of said optical pickup carry out in a radial direction and the tangential direction, respectively, and amending the parallelism of an optical pickup and an optical disk.
[Claim 4] In the tilt control approach according to claim 2 said spindle motor The radial tilt amendment device which can be tilted to a radial direction, And it has the tangential tilt amendment device which can be tilted in the tangential direction for said spindle motor as said tilt amendment device, respectively. The control signal for tilt adjustment of the radial direction outputted from said tilt control section in said radial tilt amendment device The control signal for tilt adjustment of the tangential

direction is inputted into said tangential tilt amendment device, respectively. The tilt control approach characterized by driving a radial tilt amendment device and a tangential tilt amendment device, respectively, making the tilt of said spindle motor carry out in a radial direction and the tangential direction, respectively, and amending the parallelism of an optical pickup and an optical disk.
[Claim 5] Two parallel shafts which show said optical pickup to radial [of an optical disk] in the tilt control approach according to claim 2, The radial tilt amendment device to which make it engage with the end section of one shaft among the shafts concerned, and it is arranged in, move the shaft end section concerned, and a radial direction is made to carry out tilt of said optical pickup, It has the tangential direction amendment device of the shaft of another side to which make it engage with the end section at least, and it is arranged in, move the shaft of said another side, and the tilt of said optical pickup is made to carry out in the tangential direction as said tilt amendment device. The control signal for tilt adjustment of the radial direction outputted from said tilt control section in said radial tilt amendment device The control signal for tilt adjustment of the tangential direction is inputted into said tangential tilt amendment device, respectively. The tilt control approach characterized by driving a radial tilt amendment device and a tangential tilt amendment device, respectively, making the tilt of said optical pickup carry out in a radial direction and the tangential direction, respectively, and amending the parallelism of an optical pickup and an optical disk.
[Claim 6] In the tilt control approach according to claim 2, it is arranged into the path along which the laser reflected light from the optical disk in said optical pickup passes. It has the classified liquid crystal shutter section which adjusts the amount of transmitted lights by electrical-potential-difference impression for two or more shutter fields of every, and amends the laser reflected light as said tilt amendment device. To said predetermined shutter field in which it is postponed until the tilt of a radial direction by the laser reflected light with the control signal for tilt adjustment of the radial direction outputted from said tilt control section And input into a predetermined shutter field different from the above with which it is postponed until the tilt of the tangential direction by the laser reflected light with the control signal for tilt adjustment of the tangential direction, respectively, and the amount of transmitted lights in each shutter field is adjusted. The tilt control approach characterized by amending a gap of the laser reflected light accompanying the tilt to a radial direction and the tangential direction.
[Claim 7] The optical disk unit characterized by using the tilt control approach according to claim 1 to 6.

[Translation done.]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the optical disk unit using the tilt control approach and this which can perform playback by which the optical disk accompanied by field blurring was stabilized in optical disk playback of CD, DVD, etc. with an optical disk unit.
[0002]
[Description of the Prior Art] In an optical disk unit, the jitter of the regenerative signal generated by the tilt (inclination of the signal recording surface in the optical disk to the laser beam irradiated from an optical pickup) gets worse as the recording density of an optical disk increases, and it becomes large [one layer of effect nearby which the tilt produced with the error of mechanism-element anchoring exerts on a jitter]. For this reason, the tilt amendment device of the optical pickup which cancels from the former the tilt produced in mechanism-element anchoring in an optical disk unit was used. The structure which adjusts the sense of the shaft for guidance of an optical pickup, and performs gate adjustment of an optical pickup as an example of such a conventional tilt amendment device is shown in drawing 15 . Drawing 15 is the block diagram of the conventional optical disk unit.
[0003] In drawing 15 the tilt amendment device of the conventional optical disk unit The optical pickup 2 which irradiates a laser beam at an optical disk (illustration is omitted), Two shafts 25 and 26 which show an optical pickup 2 to radial [of an optical disk], The radial tilt adjusting screw 23 which is arranged in one shaft 25 edge and performs inclination adjustment in the optical disk radial of the laser beam shaft of an optical pickup 2, It is a configuration equipped with the tangential tilt adjusting screw 24 which is arranged in shaft 26 edge of another side, and performs inclination adjustment in the optical disk tangential direction of a laser beam shaft.
[0004] It is the structure which is made to go up and down two shafts 25 and 26 edges with two adjusting screws 23 and 24, and performs gate adjustment (tilt adjustment) of an optical pickup 2 in an above-mentioned optical disk unit. He stops a tilt and is trying for the jitter of a regenerative signal to serve as min by the radial tilt adjusting screw's 23 adjusting inclination adjustment optical disk radial [in the laser beam shaft irradiated from an optical pickup 2], and adjusting inclination adjustment of an optical disk tangential direction with the tangential tilt adjusting screw 24, respectively.
[0005]
[Problem(s) to be Solved by the Invention] What [can suppress skew generating by the error of mechanism-element anchoring by the conventional optical disk unit being constituted as mentioned above, and performing gate adjustment (tilt adjustment) of an optical pickup 2] When the optical disk itself has the face deflection (deformation in an optical disk hand of cut) exceeding tolerance A skew occurs in the predetermined laser beam irradiated location of an optical disk at the time of optical disk playback. And the amount of skews changed into the condition of changing a lot, by rotation of an optical disk, and by the conventional adjustment device, it could not amend but had the trouble of a jitter increasing and it becoming impossible to play an optical disk correctly.
[0006] It was made in order that this invention might solve the above-mentioned trouble, and the tilt

generated by the face deflection of an optical disk is amended appropriately, and it aims at offering the optical disk unit using the tilt control approach and this which can perform data readout which suppressed generating of a jitter and was stabilized.

[0007]

[Means for Solving the Problem] In order to solve the above-mentioned technical problem, the tilt control approach of this invention The spindle motor made to rotate an optical disk and the optical pickup which receives the laser reflected light from an optical disk while irradiating a laser beam at an optical disk, The detector which changes into an electrical signal the lightwave signal reflected with the optical disk, The focal actuator which drives an optical pickup in the direction of a focus so that the focus of a laser beam may always suit to an optical disk signal side, The tracking actuator which drives an optical pickup in the direction of tracking so that a laser beam may always follow to the truck of the shape of the shape of a spiral of an optical disk, and a concentric circle, The servo processor which performs each servo control of the focal control to a focal actuator, and the tracking control to a tracking actuator based on the signal outputted from a detector, The tilt amendment device which amends the gap in the optical pickup of the laser reflected light from the optical disk at the time of tilt generating, It is the tilt control approach of the optical disk unit equipped with a jitter detection means to detect a jitter, from the data signal generated based on the signal for optical disk read-out among the tilt control section which performs actuation control of the tilt amendment device concerned, and the electrical signal changed by the detector, and a synchronous clock. The focal control signal outputted from a servo processor to a focal actuator is inputted also into a tilt control section. The tilt adjustment based on the focal control signal with which the tilt control section concerned changes corresponding to the amount of tilts produced with an optical disk configuration is made to carry out to a tilt amendment device.

[0008] Thereby, the tilt of the radial direction of an optical disk or the tangential direction occurs by the face deflection of an optical disk, even when the optical axis of the laser reflected light from an optical disk inclines and it has shifted, the light-receiving condition of the laser reflected light in an optical pickup is improved, and the optical disk unit which can perform data readout which suppressed generating of a jitter and was stabilized is obtained.

[0009]

[Embodiment of the Invention] The spindle motor which invention of this invention according to claim 1 makes rotate an optical disk, The optical pickup which receives the laser reflected light from an optical disk while irradiating a laser beam at an optical disk, The detector which changes into an electrical signal the lightwave signal reflected with the optical disk, The focal actuator which drives an optical pickup in the direction of a focus so that the focus of a laser beam may always suit to an optical disk signal side, The tracking actuator which drives an optical pickup in the direction of tracking so that a laser beam may always follow to the truck of the shape of the shape of a spiral of an optical disk, and a concentric circle, The servo processor which performs each servo control of the focal control to a focal actuator, and the tracking control to a tracking actuator based on the signal outputted from a detector, The tilt amendment device which amends the gap in the optical pickup of the laser reflected light from the optical disk at the time of tilt generating, It is the tilt control approach of the optical disk unit equipped with a jitter detection means to detect a jitter, from the data signal generated based on the signal for optical disk read-out among the tilt control section which performs actuation control of the tilt amendment device concerned, and the electrical signal changed by the detector, and a synchronous clock. The focal control signal outputted from a servo processor to a focal actuator is inputted also into a tilt control section. It is the tilt control approach characterized by making the tilt adjustment based on the focal control signal with which the tilt control section concerned changes corresponding to the amount of tilts produced with an optical disk configuration carry out to a tilt amendment device. Even when the tilt of the radial direction of an optical disk and the tangential direction occurs periodically by the face deflection of an optical disk, the optical axis of the reflected light from an optical disk inclines and it shifts From supporting one to one, the focal control signal change accompanying face deflection, and the amount change of tilts by face deflection It has an operation that actuation control of the tilt amendment device according to the amount of tilts can be ensured in inputting a focal control signal into a tilt

control section, a dissolution or the effect of a tilt is avoided for a tilt, and generating of a jitter is suppressed, it is stabilized, and data readout can be performed.

[0010] Invention according to claim 2 is set to the tilt control approach according to claim 1. While a tilt control section outputs the signal acquired by carrying out output adjustment of the inputted focal control signal as a control signal for tilt adjustment of a radial direction to a tilt amendment device Carry out output adjustment of the focal control signal, and the signal which shifted 90 degrees of phases and was acquired to the rotation location of an optical disk is outputted as a control signal for tilt adjustment of the tangential direction to a tilt amendment device. It is the tilt control approach characterized by making tilt adjustment of a radial direction and the tangential direction carry out to a tilt amendment device, respectively. As opposed to the amount change of tilts of a radial direction and the amount change of tilts of the tangential direction from which the phase serves as relation shifted 90 degrees It is based on these, the focal control signal corresponding to one to one, and the signal that shifted 90 degrees of phases of this focal control signal. Each tilt of a radial direction and the tangential direction can be certainly amended by the tilt amendment device, and it has an operation that it is stabilized also about the optical disk which has face deflection, and data readout can be performed.

[0011] Invention according to claim 3 is set to the tilt control approach according to claim 2. A focal actuator has at least three or more drives to the direction of a focus, and serves as a tilt amendment device. The control signal for tilt adjustment of the radial direction outputted from a tilt control section or the control signal for tilt adjustment of the tangential direction is inputted into a predetermined drive together with a focal control signal, respectively. It is the tilt control approach characterized by changing the generating driving force of each drive, making the tilt of the optical pickup carry out in a radial direction and the tangential direction, respectively, and amending the parallelism of an optical pickup and an optical disk. To the amount change of tilts of a radial direction, and the amount change of tilts of the tangential direction with the control signal for tilt adjustment of the direction of a focus and the control signal for tilt adjustment of the tangential direction which are made to correspond to these and are outputted from a tilt control section Two or more drives of the focal actuator as a tilt amendment device are controlled respectively, the tilt of the optical pickup is changed into the condition that a tilt is solved, and it has an operation that it is stabilized also about the optical disk which has face deflection, and data readout can be performed.

[0012] Invention according to claim 4 is set to the tilt control approach according to claim 2. A spindle motor The radial tilt amendment device which can be tilted to a radial direction, And it has the tangential tilt amendment device which can be tilted in the tangential direction for a spindle motor as a tilt amendment device, respectively. The control signal for tilt adjustment of the radial direction outputted from a tilt control section in a radial tilt amendment device The control signal for tilt adjustment of the tangential direction is inputted into a tangential tilt amendment device, respectively. A radial tilt amendment device and a tangential tilt amendment device are driven, respectively. It is the tilt control approach characterized by making the tilt of the spindle motor carry out in a radial direction and the tangential direction, respectively, and amending the parallelism of an optical pickup and an optical disk. To the amount change of tilts of a radial direction, and the amount change of tilts of the tangential direction with the control signal for tilt adjustment of the direction of a focus and the control signal for tilt adjustment of the tangential direction which are made to correspond to these and are outputted from a tilt control section Control the radial tilt amendment device as a tilt amendment device, and a tangential tilt amendment device, respectively, and a spindle motor list changes the tilt of the optical disk into the condition that a tilt is solved. It has an operation that it is stabilized also about the optical disk which has face deflection, and data readout can be performed.

[0013] Invention according to claim 5 is set to the tilt control approach according to claim 2. Two parallel shafts which show an optical pickup to radial [of an optical disk], The radial tilt amendment device to which make it engage with the end section of one shaft among the shafts concerned, and it is arranged in, move the shaft end section concerned, and a radial direction is made to carry out tilt of the optical pickup, It has the tangential direction amendment device of the shaft of another side to which make it engage with the end section at least, and it is arranged in, move the shaft of another side, and the

tilt of the optical pickup is made to carry out in the tangential direction as a tilt amendment device. The control signal for tilt adjustment of the radial direction outputted from a tilt control section in a radial tilt amendment device The control signal for tilt adjustment of the tangential direction is inputted into a tangential tilt amendment device, respectively. A radial tilt amendment device and a tangential tilt amendment device are driven, respectively. It is the tilt control approach characterized by making the tilt of the optical pickup carry out in a radial direction and the tangential direction, respectively, and amending the parallelism of an optical pickup and an optical disk. To the amount change of tilts of a radial direction, and the amount change of tilts of the tangential direction with the control signal for tilt adjustment of the direction of a focus and the control signal for tilt adjustment of the tangential direction which are made to correspond to these and are outputted from a tilt control section The radial tilt amendment device as a tilt amendment device and a tangential tilt amendment device are controlled, respectively, the tilt of the optical pickup is changed into the condition that a tilt is solved, and it has an operation that it is stabilized also about the optical disk which has face deflection, and data readout can be performed.

[0014] Invention according to claim 6 is set to the tilt control approach according to claim 2. It is arranged into the path along which the laser reflected light from the optical disk in an optical pickup passes. It has the classified liquid crystal shutter section which adjusts the amount of transmitted lights by electrical-potential-difference impression for two or more shutter fields of every, and amends the laser reflected light as a tilt amendment device. To the predetermined shutter field to which it is postponed until the tilt of a radial direction by the laser reflected light with the control signal for tilt adjustment of the radial direction outputted from a tilt control section And if it is postponed until the tilt of the tangential direction by the laser reflected light with the control signal for tilt adjustment of the tangential direction, will input into another predetermined shutter field, respectively, and the amount of transmitted lights in each shutter field is adjusted. It is the tilt control approach characterized by amending a gap of the laser reflected light accompanying the tilt to a radial direction and the tangential direction. To the amount change of tilts of a radial direction, and the amount change of tilts of the tangential direction with the control signal for tilt adjustment of the direction of a focus and the control signal for tilt adjustment of the tangential direction which are made to correspond to these and are outputted from a tilt control section Control two or more shutter fields of the liquid crystal shutter section as a tilt amendment device, respectively, and a gap of the laser reflected light accompanying a tilt is amended. The reflected light can be correctly changed into an electrical signal by the detector, and it has an operation that it is stabilized also about the optical disk which has face deflection, and data readout can be performed.

[0015] It is the optical disk unit characterized by invention according to claim 7 using the tilt control approach according to claim 1 to 6. Even when the tilt of the radial direction of an optical disk and the tangential direction occurs periodically by the face deflection of an optical disk, the optical axis of the reflected light from an optical disk inclines and it shifts From supporting one to one, the focal control signal change accompanying face deflection, and the amount change of tilts by face deflection It has an operation that actuation control of the tilt amendment device according to the amount of tilts can be ensured in inputting a focal control signal into a tilt control section, a dissolution or the effect of a tilt is avoided for a tilt, and generating of a jitter is suppressed, it is stabilized, and data readout can be performed.

[0016] Hereafter, the gestalt of operation of this invention is explained, referring to drawing 1 - drawing 14 .

[0017] (Gestalt 1 of operation) Drawing 1 is the block diagram of the optical disk unit in the gestalt 1 of operation of this invention. In drawing 1 , the optical disk unit concerning the gestalt of this operation The optical pickup 2 which receives the light reflected with the optical disk 1 while irradiating a laser beam at an optical disk 1, A signal which the reflected light from the optical disk 1 obtained by this optical pickup 2 is changed into a current, and is an output signal for focal error detection to the list for data readout from an optical disk 1, B signal, C signal, and D signal, The detector 3 which outputs each electrical signal of E signal which is an output signal for tracking error detection, and F signal, The focal

error signal which is a difference signal with the signal adding the signal, B signal, and D signal adding A signal and C signal which are outputted from this detector 3 While generating the tracking error signal (following and TE signal and abbreviated name) which is a difference signal from E signal which generates (following and FE signal and an abbreviated name), and is outputted from a detector 3, and F signal RF amplifier 4 which adds A signal outputted from a detector 3, B signal, C signal, and D signal, and generates a RF signal, The focal actuator 5 which drives an optical pickup 2 in the direction of a focus, The tracking actuator 6 which drives an optical pickup 2 in the direction of tracking, While controlling the focal actuator 5 so that TE signal and FE signal are inputted from RF amplifier 4 and the focus of a laser beam always suits an optical disk 1 signal side based on FE signal The servo processor 7 which controls the tracking actuator 6 so that a laser beam always follows to the truck of the shape of the shape of a spiral of an optical disk 1, and a concentric circle based on TE signal, The tilt amendment device 8 which amends the tilt produced between an optical disk 1 and an optical pickup 2, The equalizer and the PLL circuit 9 (EQ/PLL circuit) which shape a RF signal in waveform and generate the binarization signal (it is expressed as DATA in drawing 1) of RF, and a synchronous clock (it is expressed as CLK in drawing 1), A binarization signal and the jitter detector 10 which detects a jitter from a synchronous clock, It is a configuration equipped with CPU11 which the detection condition of a jitter is inputted from the jitter detector 10, and controls the servo processor 7, and the tilt control circuit 12 as a tilt control section which performs drive control of the tilt amendment device 8.
[0018] The focal control signal outputted from the servo processor 7 to the focal actuator 5 is inputted into the tilt control circuit 12, it carries out output adjustment of this focal control signal, and outputs it to the tilt amendment device 8, and tilt adjustment is performed corresponding to the tilt change in the hand of cut of an optical disk 1.
[0019] Here, drawing 2 is the radial direction tilt generating concept explanatory view of the optical disk unit of drawing 1 . In drawing 2 , the radial direction tilt generating concept in the optical disk which has field blurring is explained. As shown in drawing 2 , while the focal location of an optical pickup 2 is located in the top section, the amount of the maximum tilts occurs in the top point of field blurring. Moreover, when an optical disk 1 and an optical pickup 2 become parallel, while a focal location turns into a criteria location, the amount of tilts is set to 0. In the lowest point of field blurring, while a focal location is located in the lowest section, the amount of the maximum tilts occurs.
[0020] Moreover, drawing 3 is the tangential direction tilt generating concept explanatory view of the optical disk unit of drawing 1 . In drawing 3 , the tangential direction tilt generating concept in the optical disk which has field blurring is explained. As shown in drawing 3 , while the focal location of an optical pickup 2 is located in the top section, the amount of tilts is set to 0 in the top point of field blurring. Moreover, when an optical disk 1 and an optical pickup 2 become parallel, the amount of the maximum tilts generates a focal location while it turns into a criteria location. Moreover, in the lowest point, while a focal location is located in the lowest section, the amount of tilts is set to 0.
[0021] As mentioned above, in rotation of the optical disk which has field blurring, while the amount of tilts changes with field blurring, the focal location change by rotation of an optical disk 1, i.e., change of the focal control signal in the focal control which makes an optical pickup 2 follow in footsteps of an optical disk side location, has the relation corresponding to change and one to one of the amount of tilts.
[0022] From this, as shown in drawing 1 , a focal control signal (it is expressed as FoDrv in drawing 1) can be inputted into the tilt control circuit 12, and the effect by the tilt can be canceled synchronizing with the amount change of tilts by rotation by controlling the tilt amendment device 8 based on a focal control signal, and it becomes possible to perform stable data playback to the optical disk which has field blurring.
[0023] (Gestalt 2 of operation) The optical disk unit concerning the gestalt 2 of operation of this invention is explained based on drawing 4 and drawing 5 . A tilt control-block Fig. [in / in drawing 4 / the gestalt 2 of operation of this invention] and drawing 5 are the related explanatory views of the tilt angle of drawing 4 , and a tilt control signal.
[0024] As a tilt control circuit 12 in the same configuration as the gestalt 1 of operation, as shown in drawing 4 , the optical disk unit concerning the gestalt 2 of this operation The automatic gain control

circuit 13 for seting always constant the amplitude of a focal control signal (it is expressed as FoDrv in drawing 4) (the following, AGC, and abbreviated name), The A/D-conversion circuit 14 which changes into digital value the signal outputted from AGC13, The D/A conversion circuit 15 for changing into an analog value the digital value outputted from the A/D-conversion circuit 14, The buffer circuit 16 which can output the value outputted from the D/A conversion circuit 15 by the gain of arbitration by control of CPU11, The shift register 17 for outputting the data which were made to shift the data outputted from the A/D-conversion circuit 14 by the rotation pulse of a spindle motor (illustration is omitted), and shifted 90 degrees of phases to the rotation period, It is a configuration equipped with the D/A conversion circuit 18 for changing into an analog value the digital value outputted from a shift register 17, and the buffer circuit 19 which can output the value outputted from the D/A conversion circuit 18 by the gain of arbitration by control of CPU11.
[0025] Actuation of a tilt control circuit is explained based on drawing 5 . As drawing 5 shows, the radial tilt angle and the tangential tilt angle serve as phase relation shifted 90 degrees. Moreover, although a period becomes the same on inner circumference and a periphery, since it becomes the signal with which amplitude differs, this signal cannot be used for a focal control signal by the tilt amendment device 8 as it is. Therefore, first, to a focal control signal, AGC13 is used and it controls to become the signal of the always same amplitude. Moreover, it is necessary to generate the signal with which 90 degrees of phases shifted to the focal control signal for amendment of a tangential tilt angle. For this reason, while performing A/D conversion to the signal outputted from AGC13 in the A/D-conversion circuit 14 and performing data generation as digital data, referring to the rotation pulse of a spindle motor, data are shifted with a shift register 17 and the digital data of the phase shifted 90 degrees is generated.
[0026] Next, the digital data with which it is the D/A conversion circuit 15, and 90 degrees of phases shifted the digital data is returned to an analog value by the D/A conversion circuit 18, respectively, and the signal which is two from which 90 degrees of phases shifted is generated. It is possible to generate the signal with which it was not dependent on the rotational speed of an optical disk 1 with a signal, and 90 degrees of phases always shifted by using the above-mentioned method.
[0027] A radial tilt control signal (RtDRV) and a tangential tilt control signal (TtDRV) are acquired by inputting each generated signal into the buffer circuits 16 and 19 in which an output is possible by the gain of arbitration. The tilt amendment device 8 shown in drawing 1 will be controlled by these signals.
[0028] Thus, based on a radial tilt control signal and a tangential tilt control signal, each tilt of a radial direction and the tangential direction can be certainly amended by the tilt amendment device 8, and an optical disk unit equipped with the tilt control approach shown in the gestalt 2 of this operation enables it to perform stable data playback to the optical disk which has field blurring.
[0029] (Gestalt 3 of operation) The optical disk unit concerning the gestalt 3 of operation of this invention is explained based on drawing 6 thru/or drawing 9 .
[0030] The focal actuator 5 of a multiaxial ejector half is used for the optical disk unit concerning the gestalt 3 of this operation as a tilt amendment device controlled by the tilt control circuit 12 in the gestalt 2 of operation.
[0031] The block diagram of a focal actuator [in / in drawing 6 / the gestalt 3 of operation of this invention] and drawing 7 are the drive block diagrams of the actuator of drawing 6 . As shown in drawing 6 , it is the structure from which the focal coil of the focal actuator 5 enables each tilt adjustment of a radial direction and the tangential direction in addition to focal control, and serves as the tilt amendment device 8 by being divided into four, Coil A, Coil B, Coil C, and Coil D, and changing the current passed in each coil.
[0032] As shown in drawing 7 , moreover, this tilt amendment device While inputting a focal control signal (FoDRV) into all coils and generating the driving force of the direction of a focus The radial tilt control signal (RtDRV) outputted from the tilt control circuit 12 is added to the input signal to Coil A and Coil B. And by adding a tangential tilt control signal (TtDRV) to the input signal to Coil A and Coil D The driving force of the direction of a focus in each coil is changed, and the tilt of the optical pickup 2 principal part is made to carry out in a radial direction and the tangential direction.

[0033] Here, the gain-adjustment approach of the radial tilt control signal in the tilt control circuit to the tilt amendment device in the gestalt 3 of this operation is explained using the flow chart of drawing 8 . Drawing 8 is the gain-adjustment flow chart of radial tilt control of drawing 7 . As a premise, a jitter value [in / set point / of radial tilt control / retrieval initiation / StartRtGain and the last set point and / for alpha and a gain setting register / in a step / RtGain and its setup] is assumed to be BestRtGain as a variable for gain setting storing in Bestjit and the best jitter as jit (RtGain) and a variable for the best jitter storing. [EndRtGain]
[0034] First, as initialization, maximum (FFFFh) is inputted into Bestjit, BestRtGain is cleared (0h), and StartRtGain is set as RtGain (Step1). Next, the jitter value jit (RtGain) in RtGain is measured (Step2).
[0035] If jit (RtGain) is small, while it compares with Bestjit the jitter value jit (RtGain) measured by Step2 (Step3), and assigning a Bestjit value to jit (RtGain), BestRtGain is updated as a value of RtGain (Step4). Furthermore, the value of RtGain is incremented by alpha (Step5). With [jit (RtGain)] Bestjit [more than], in Step3, it shifts to Step5 as it is.
[0036] The value and EndRtGain of RtGain are compared after Step5 (Step6), with [the value of RtGain] EndRtGain [below], it shifts to Step2 and a process is repeated.
[0037] On the other hand, if the value of RtGain is larger than EndRtGain, as RtGain, the value of BestRtGain will be set up (Step7) and a series of processings will be finished.
[0038] Then, the gain-adjustment approach of the tangential tilt control signal in the tilt control circuit to the tilt amendment device in the gestalt 3 of this operation is explained using the flow chart of drawing 9 . Drawing 9 is the gain-adjustment flow chart of tangential control of drawing 7 . As a premise, a jitter value [in / set point / of tangential tilt control / retrieval initiation / StartTtGain and the last set point and / for beta and a gain setting register / in a step / TtGain and its setup] is assumed to be BestTtGain as a variable for gain setting storing in Bestjit and the best jitter as jit (TtGain) and a variable for the best jitter storing. [EndTtGain]
[0039] First, as initialization, maximum (FFFFh) is inputted into Bestjit, BestTtGain is cleared (0h), and StartTtGain is set as TtGain (Step11). Next, the jitter value jit (TtGain) in TtGain is measured (Step12).
[0040] If jit (TtGain) is small, while it compares with Bestjit the jitter value jit (TtGain) measured by this Step12 (Step13), and assigning a Bestjit value to jit (TtGain), the value of TtGain is updated to BestTtGain (Step14). Furthermore, the value of TtGain is incremented by beta (Step15). In Step13, if jit (TtGain) is beyond the value of Bestjit, it will shift to Step15 as it is.
[0041] TtGain is compared with EndTtGain after Step15 (Step16), with [the value of TtGain] EndTtGain [below], it shifts to Step12 and a process is repeated.
[0042] On the other hand, if the value of TtGain is larger than EndTtGain, as TtGain, a BestTtGain value will be set up (Step17) and a series of processings will be finished.
[0043] While the radial tilt control signal which the optimal gain of a tangential tilt control signal was determined as the radial tilt control signal list, and was adjusted to the optimal gain by each above processing is added to the input signal to Coil A and Coil B The tangential tilt control signal adjusted to the optimal gain is added to the input signal to Coil A and Coil D. It will be adjusted appropriately, and the driving force of the direction of a focus in each coil carries out tilt of the optical pickup 2 principal part to the tilt of a radial direction and the tangential direction, can cancel a tilt, and becomes possible [performing stable data playback].
[0044] (Gestalt 4 of operation) The optical disk unit concerning the gestalt 4 of operation of this invention is explained based on drawing 10 and drawing 11 . A tilt amendment organization chart [in / in drawing 10 / the gestalt 4 of operation of this invention] and drawing 11 are the block diagrams of the tilt amendment in the gestalt 4 of operation of this invention. It is a configuration equipped with the motor 21 for the tangential tilt amendment it is arranged in the tangential direction and parallel by the motor 20 for the radial tilt amendment to which are arranged in a radial direction and parallel by about 27 spindle motor as shown in drawing 10 as a tilt amendment device controlled by the tilt [in / in the optical disk unit concerning the gestalt 4 of this operation / the gestalt 2 of operation] control circuit 12, and a radial direction is made to carry out tilt of the spindle motor 27, and about 27 spindle motor, and the tilt of the spindle motor 27 is made to carry out in the tangential direction.

[0045] Moreover, as shown in drawing 11 , the radial tilt control signal (RtDRV) outputted from the tilt control circuit 12 is used as a driving signal of the motor 20 for radial tilt amendment, and a tangential tilt control signal (TtDRV) is used as a driving signal of the motor 21 for tangential tilt amendment, respectively. The gain-adjustment approach of the radial tilt control signal in a tilt control circuit and a tangential control signal is the same as that of the gestalt 3 of operation, and omits explanation.
[0046] In the tilt amendment device in the above-mentioned gestalt 4 of this operation While the radial tilt control signal adjusted to the optimal gain is inputted into the motor 20 for radial tilt amendment The tangential tilt control signal adjusted to the optimal gain is inputted into the motor 21 for tangential tilt amendment. The motor 21 for tangential tilt amendment will drive appropriately in the motor 20 list for radial tilt amendment. Tilt of a spindle motor 27 and the optical disk (illustration is omitted) is carried out to the tilt of a radial direction and the tangential direction, a tilt can be canceled, and it becomes possible to perform stable data playback.
[0047] (Gestalt 5 of operation) The optical disk unit concerning the gestalt 5 of operation of this invention is explained based on drawing 12 . Drawing 12 is a tilt amendment organization chart in the gestalt 5 of operation of this invention. As a tilt amendment device controlled by the tilt control circuit in the gestalt 2 of operation, as shown in drawing 12 , the optical disk unit concerning the gestalt 5 of this operation It is arranged in one shaft 25 edge among two shafts 25 and 26 which show an optical pickup 2 to radial [of an optical disk (illustration is omitted)]. It is a configuration equipped with the motor 20 for radial tilt amendment to which this shaft 25 edge is moved by predetermined within the limits, and the motor 21 for tangential tilt amendment to which it is arranged in shaft 26 edge of another side, and parallel translation of this shaft 26 is carried out by predetermined within the limits. It is the structure which is made to carry out tilt of the optical pickup 2 to a radial direction by driving the motor 20 for radial tilt amendment, and moving shaft 25 edge, and is made to carry out tilt of the optical pickup 2 in the tangential direction by driving the motor 21 for tangential tilt amendment, and moving a shaft 26.
[0048] Moreover, like the gestalt of the 4th operation, as shown in drawing 11 , a tangential tilt control signal (TtDRV) is used as motor 21 driving signal for tangential tilt amendment, respectively by making into motor 20 driving signal for radial tilt amendment the radial tilt control signal (RtDRV) outputted from a tilt control circuit. The gain-adjustment approach of the radial tilt control signal in a tilt control circuit and a tangential control signal is the same as that of the gestalten 3 and 4 of operation, and omits explanation.
[0049] In the tilt amendment device in the above-mentioned gestalt 5 of this operation While the radial tilt control signal adjusted to the optimal gain is inputted into the motor 20 for radial tilt amendment The tangential tilt control signal adjusted to the optimal gain is inputted into the motor 21 for tangential tilt amendment. The motor 21 for tangential tilt amendment will drive appropriately in the motor 20 list for radial tilt amendment. Tilt of the optical pickup 2 is carried out to the tilt of a radial direction and the tangential direction, a tilt can be canceled, and it becomes possible to perform stable data playback.
[0050] (Gestalt 6 of operation) The optical disk unit concerning the gestalt 6 of operation of this invention is explained based on drawing 13 and drawing 14 . A tilt amendment organization chart [in / in drawing 13 / the gestalt 6 of operation of this invention] and drawing 14 are the tilt amendment organization charts in the gestalt 6 of operation of this invention. The optical disk unit concerning the gestalt 6 of this operation is a configuration equipped with the liquid crystal 22 for tilt cancellation which is arranged between the detectors 3 and objective lenses in the optical pickup 2 interior, and adjusts the passage condition of the laser reflected light from an optical disk 1 as shown in drawing 13 as a tilt amendment device controlled by the tilt control circuit in the gestalt 2 of operation.
[0051] As shown in drawing 14 , liquid crystal is divided into four areas, A, B, C, and D, and by using the shutter function according turbulence of the light generated by the tilt to liquid crystal, this liquid crystal 22 for tilt cancellation can control light, and can amend return light. While using as the liquid crystal for radial tilt amendment liquid crystal A and B which is the field where it is postponed by the laser reflected light in connection with the tilt of a radial direction among four liquid crystal currently divided, liquid crystal C and D which is the field where it is postponed by the laser reflected light in

connection with the tilt of the tangential direction is used as the liquid crystal for tangential tilt amendment.

[0052] Moreover, as shown in drawing 14 , the radial tilt control signal (RtDRV) outputted from the tilt control circuit 12 is inputted as the A_Drv signal which controls liquid crystal A and B, and a B_Drv signal, and a tangential tilt control signal (TtDrv) is inputted, respectively as the C_Drv signal which controls liquid crystal C and D, and a D_Drv signal. The gain-adjustment approach of the radial tilt control signal in a tilt control circuit and a tangential control signal is the same as that of the gestalten 3, 4, and 5 of operation, and omits explanation.

[0053] In the tilt amendment device in the above-mentioned gestalt 6 of this operation While the radial tilt control signal adjusted to the optimal gain is inputted into liquid crystal A and B The tangential tilt control signal adjusted to the optimal gain Liquid crystal C It will be inputted into D and liquid crystal C and D will be appropriately controlled by liquid crystal A and B list. Adjust the amount of transmitted lights in each liquid crystal field to the laser reflected light which shifted in the tilt of a radial direction and the tangential direction, and a gap of the laser reflected light is amended. Incidence of the reflected light is correctly carried out to a detector 3, the effect by the tilt can be canceled, and it becomes possible to perform data playback stabilized also about the optical disk which has face deflection.

[0054]

[Effect of the Invention] According to this invention, the focal control signal which changes corresponding to the amount change of tilts and one to one by the face deflection of an optical disk is inputted into a tilt control section as mentioned above. By performing actuation control of a tilt amendment device based on a focal control signal by the tilt control section The advantageous effectiveness that amendment corresponding to the amount of tilts can be ensured, a dissolution or the effect of a tilt is [a tilt] avoidable, and generating of a jitter is suppressed, it is stabilized also to the optical disk which has face deflection, and data readout can be performed can be acquired.

[Translation done.]

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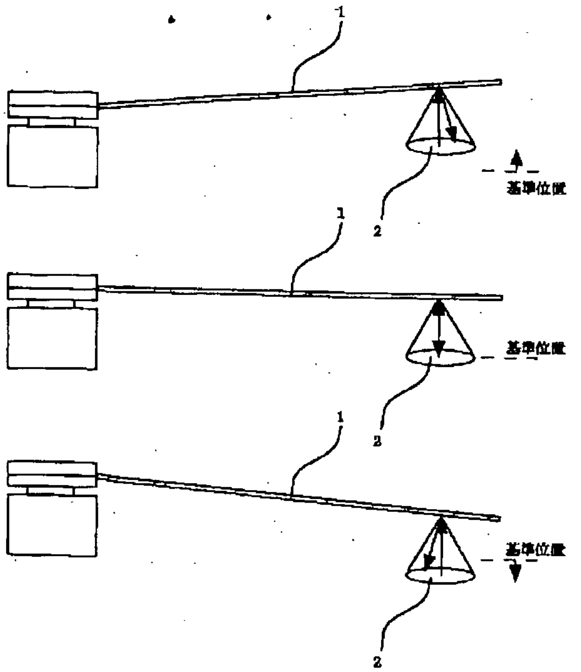

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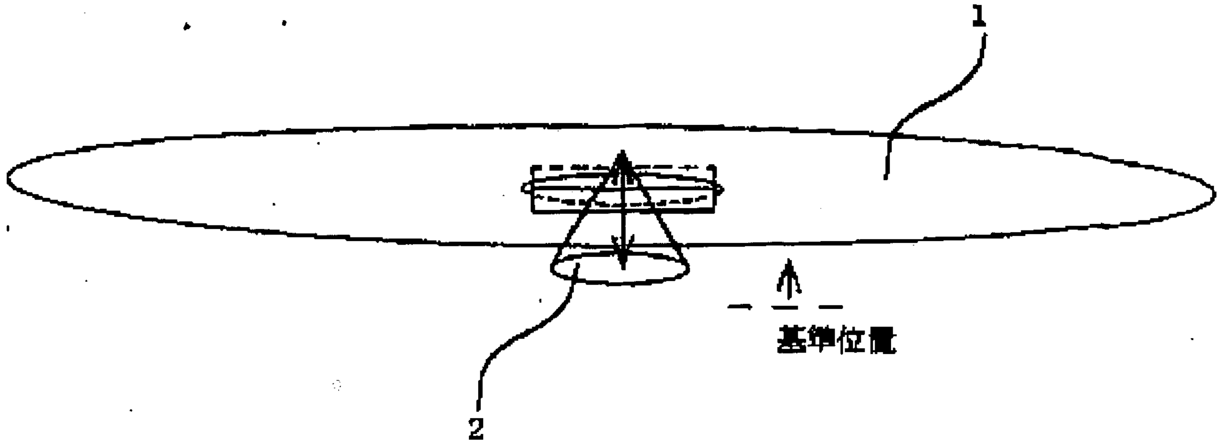
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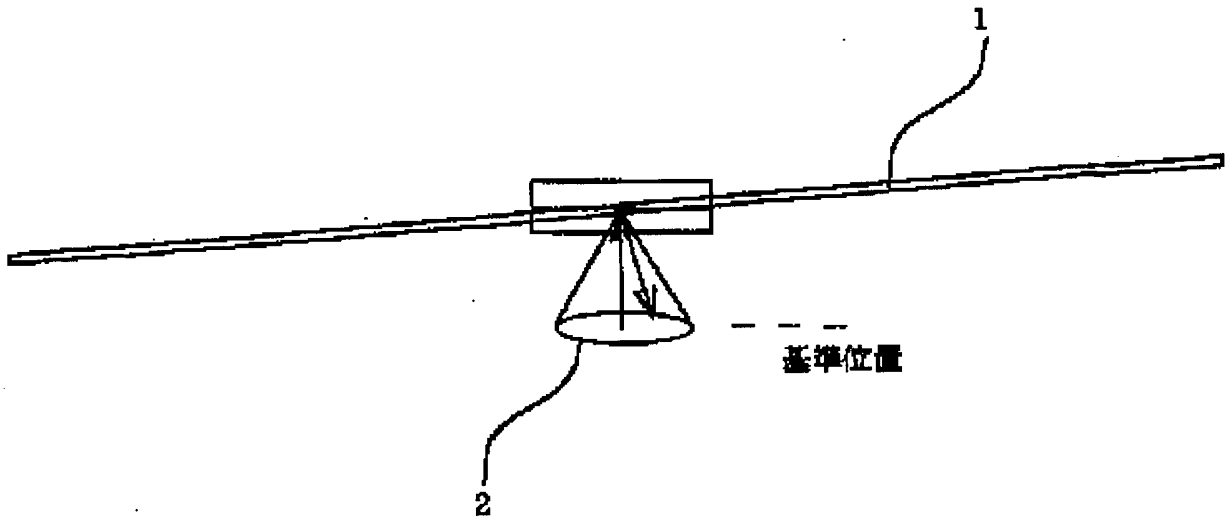
基準位置
2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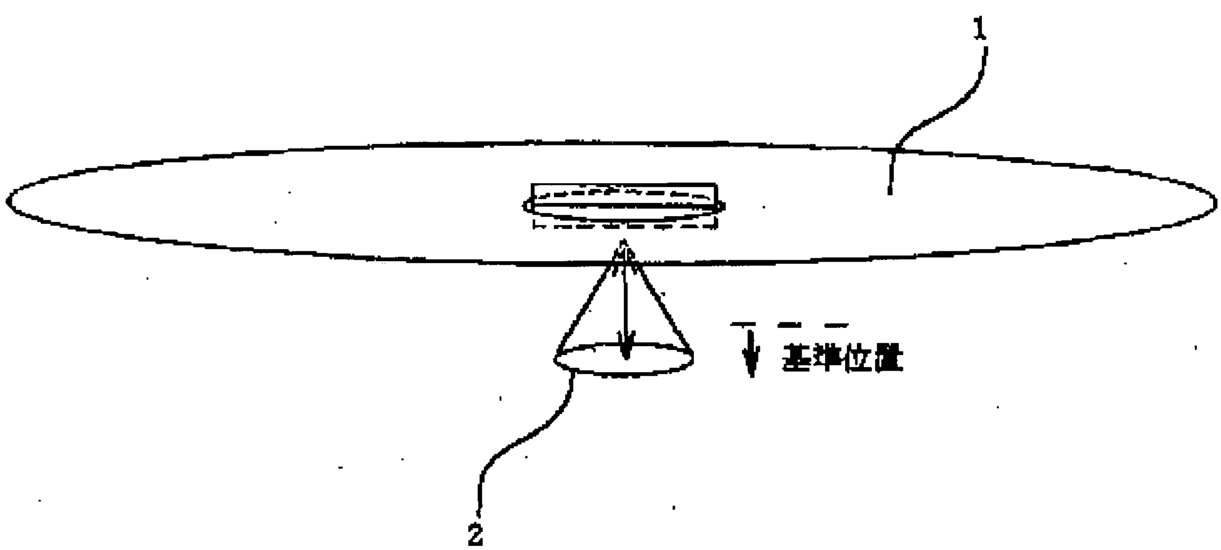
2


1
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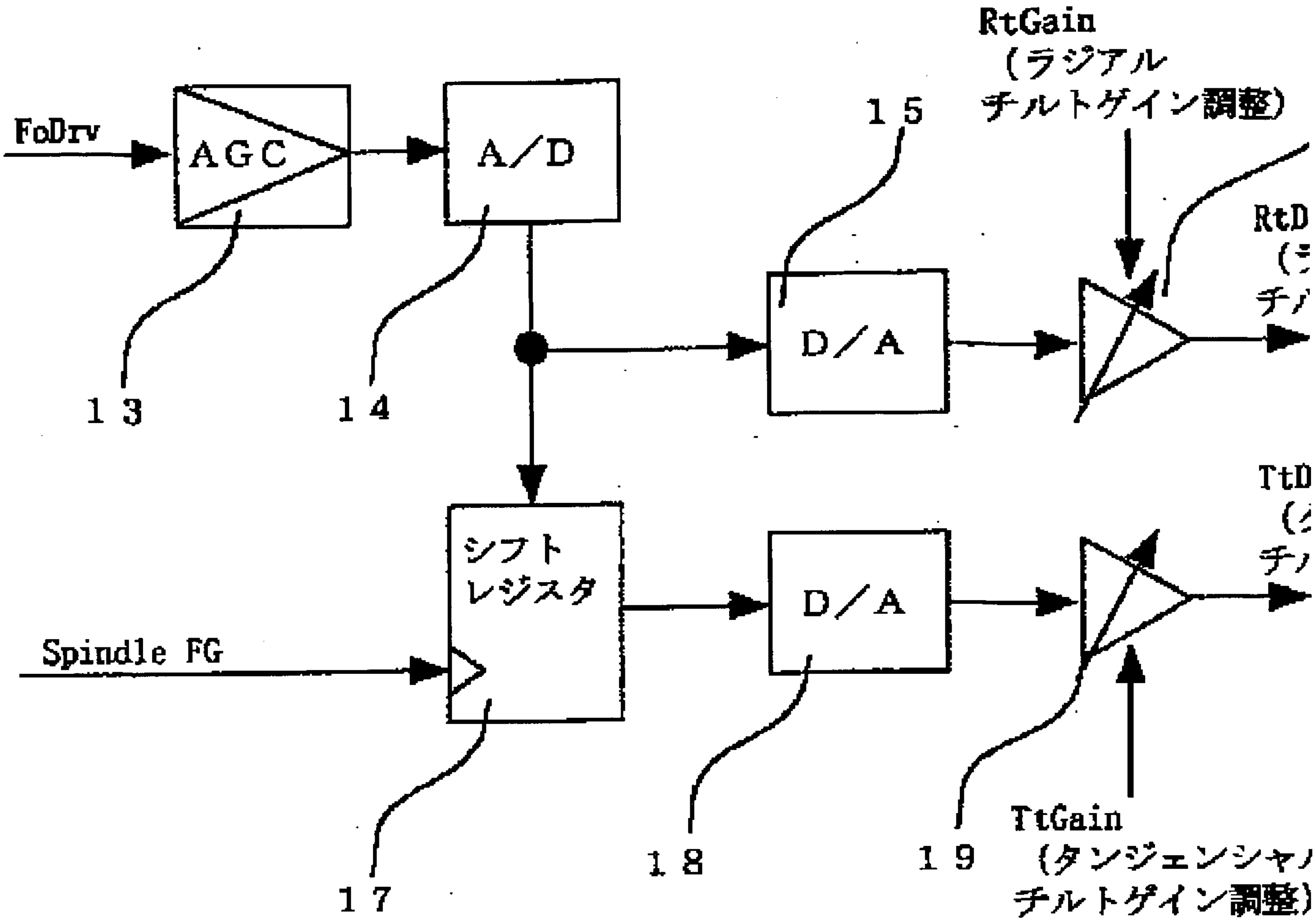
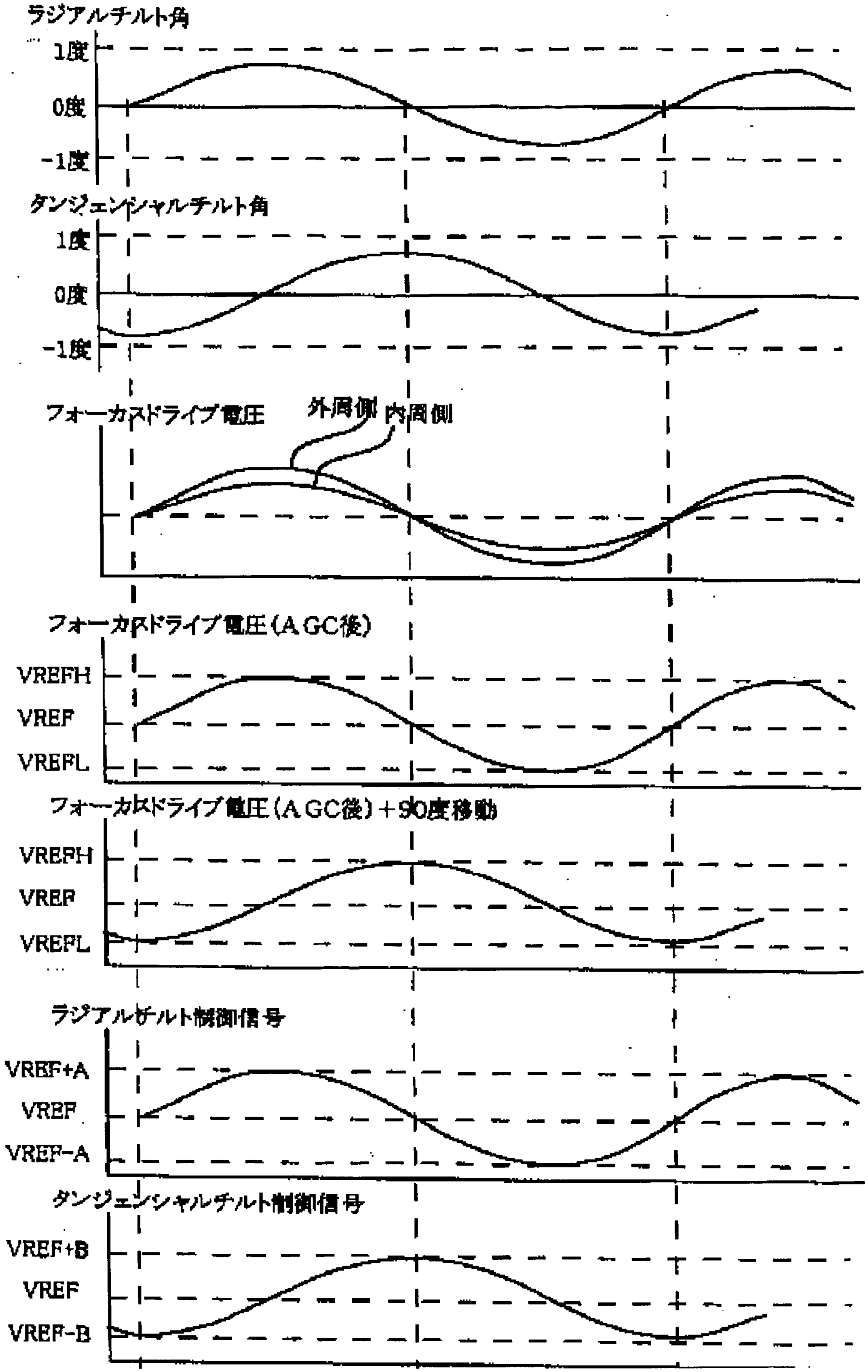
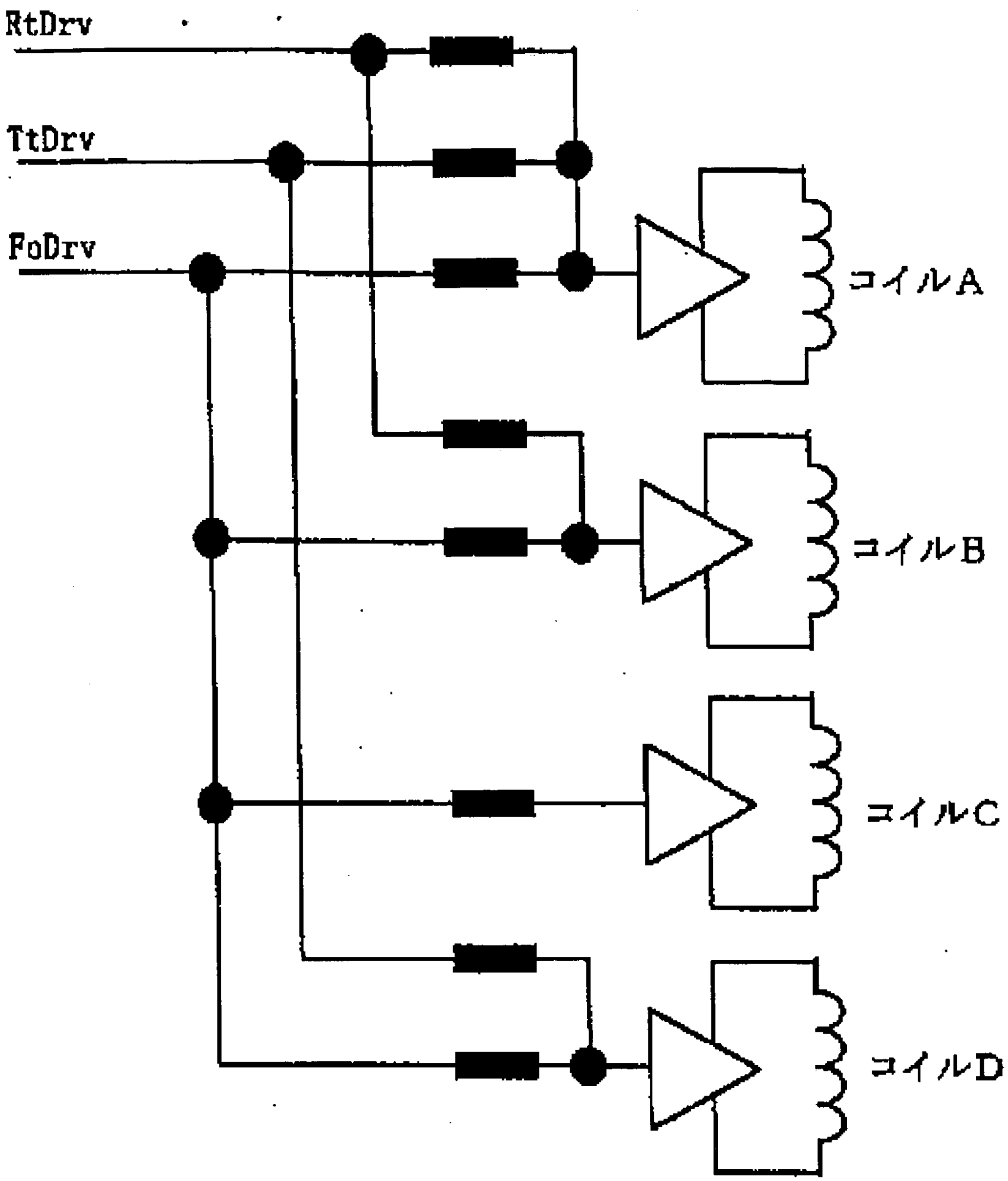
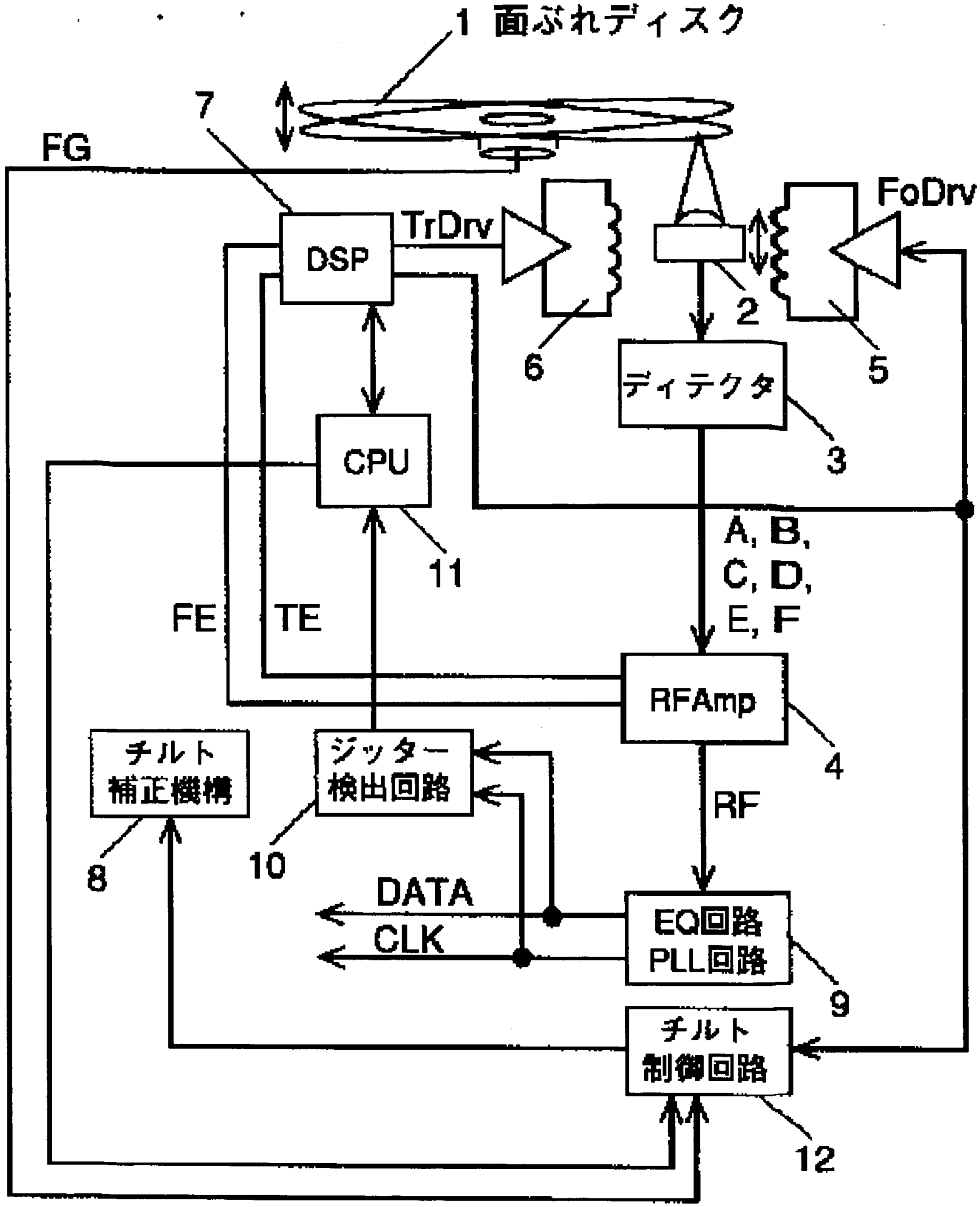
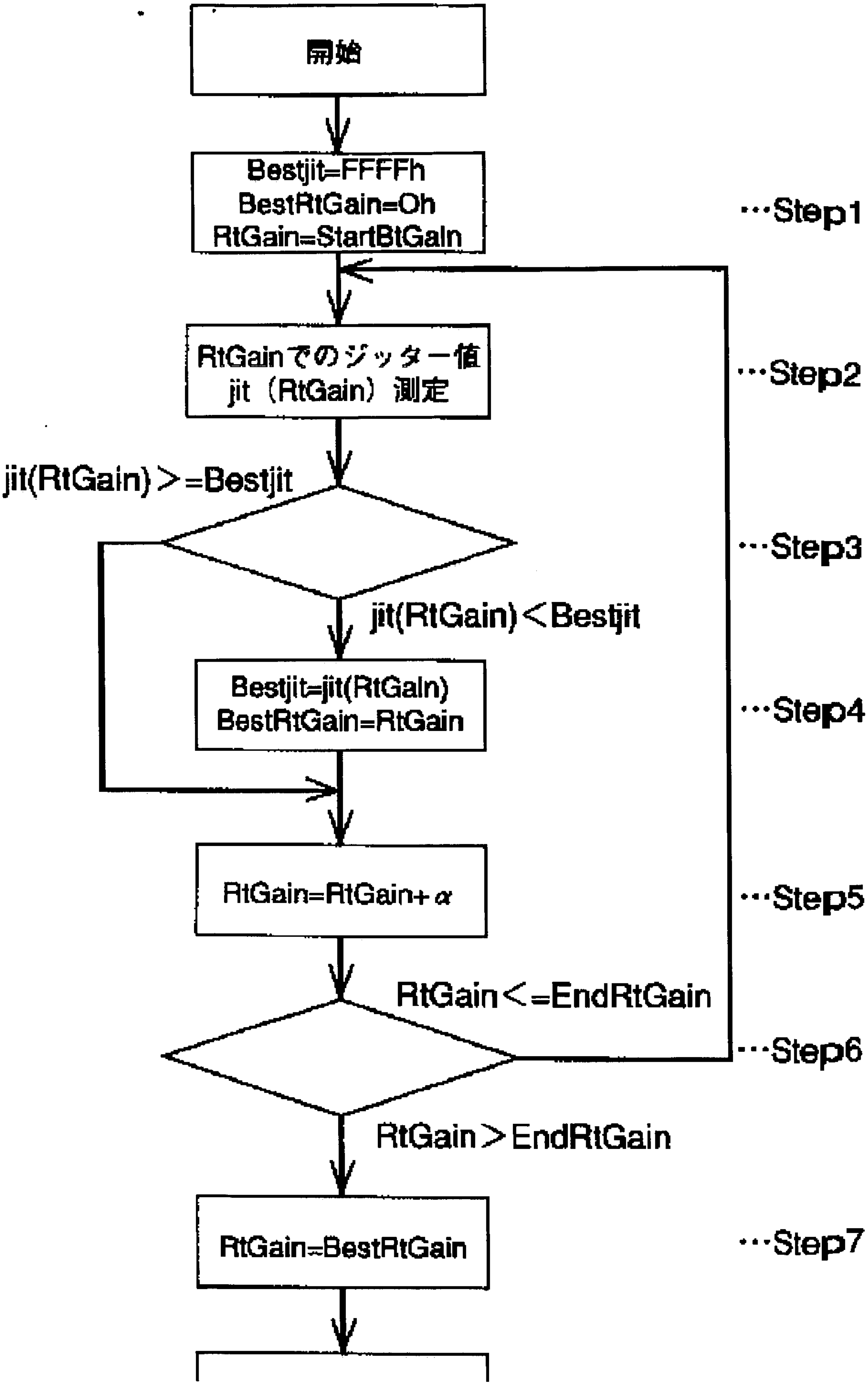
2

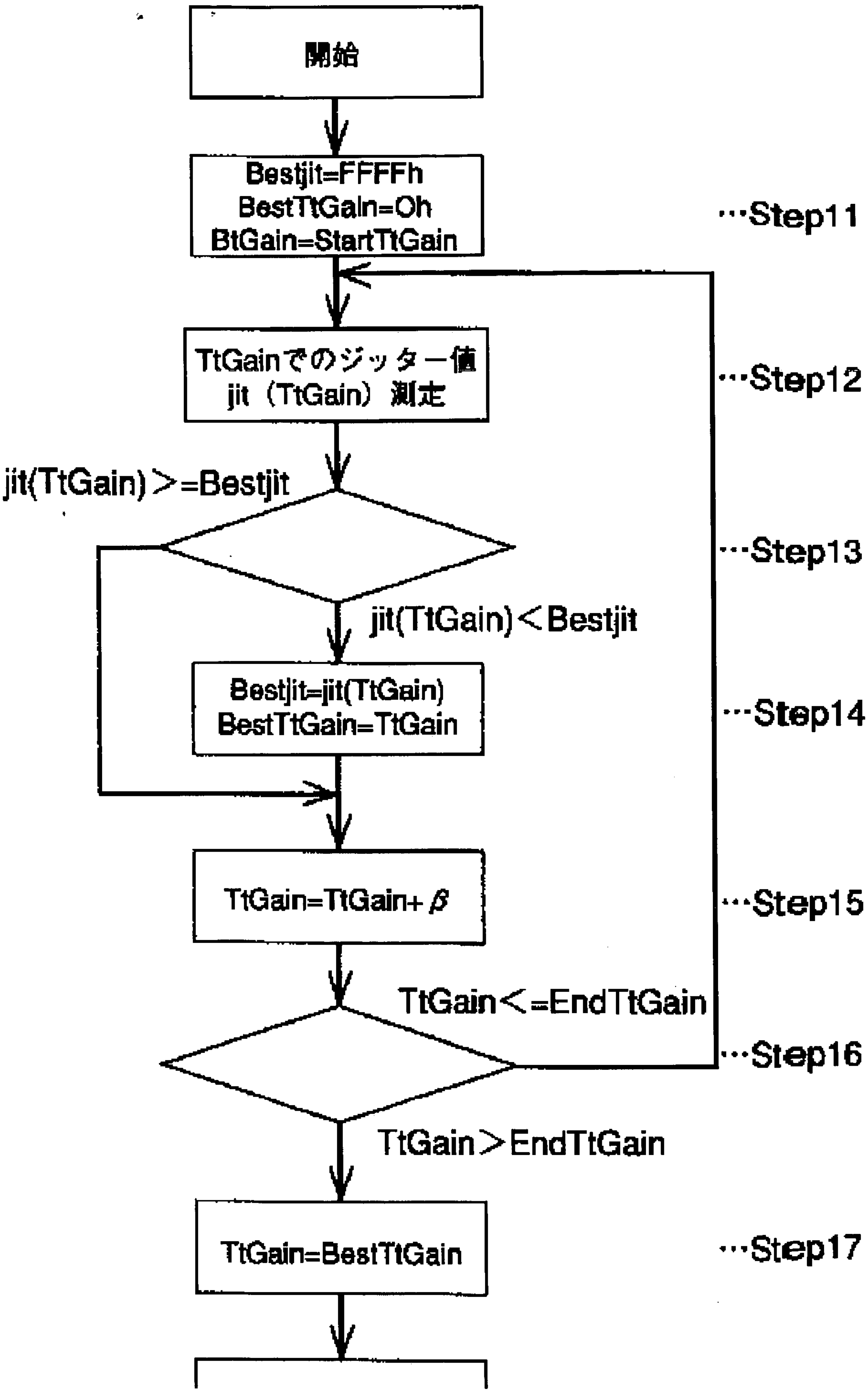

RtGain
(ラジアル
チルトゲイン調整)
FoDrv
AGC
A/D
D/A
RtD
(ラ
チル
TtD
(タ
チル
シフト
レジスタ
Spindle FG
D/A
TtGain
(タンジェンシャル
チルトゲイン調整)
13
14
15
17
18
19

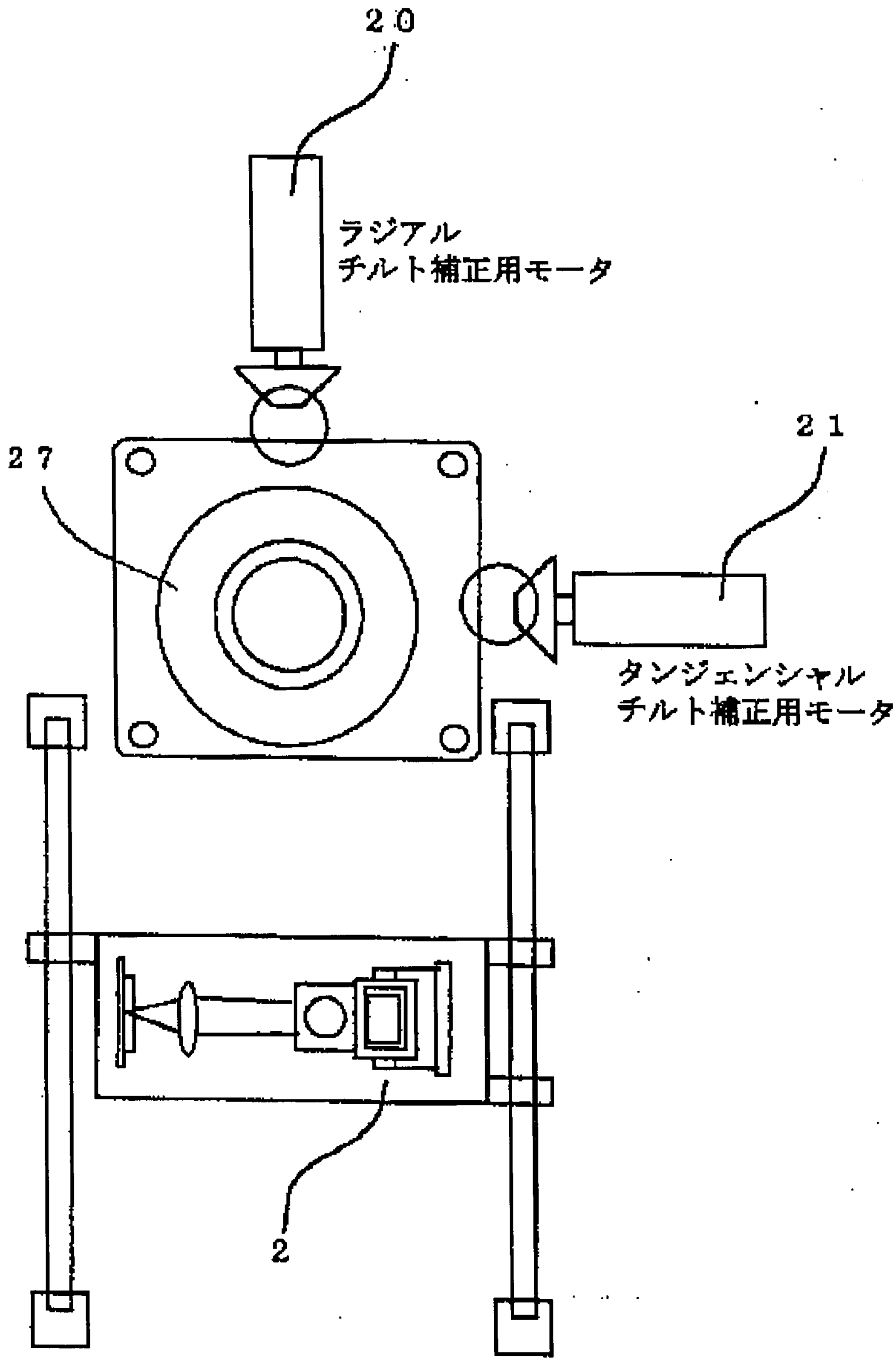

ラジアルチルト角
1度
0度
-1度
タンジェンシャルチルト角
1度
0度
-1度
フォーカスドライブ電圧
外周側
内周側
フォーカスドライブ電圧（ＡＧＣ後）
VREFH
VREF
VREFL
フォーカスドライブ電圧（ＡＧＣ後）＋90度移動
VREFH
VREF
VREFL
ラジアルチルト制御信号
VREF+A
VREF
VREF-A
タンジェンシャルチルト制御信号
VREF+B
VREF
VREF-B

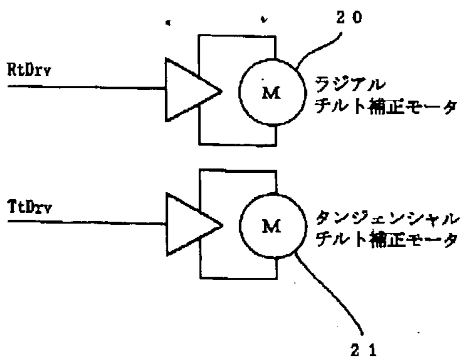

RtDrv
TtDrv
FoDrv
コイルA
コイルB
コイルC
コイルD

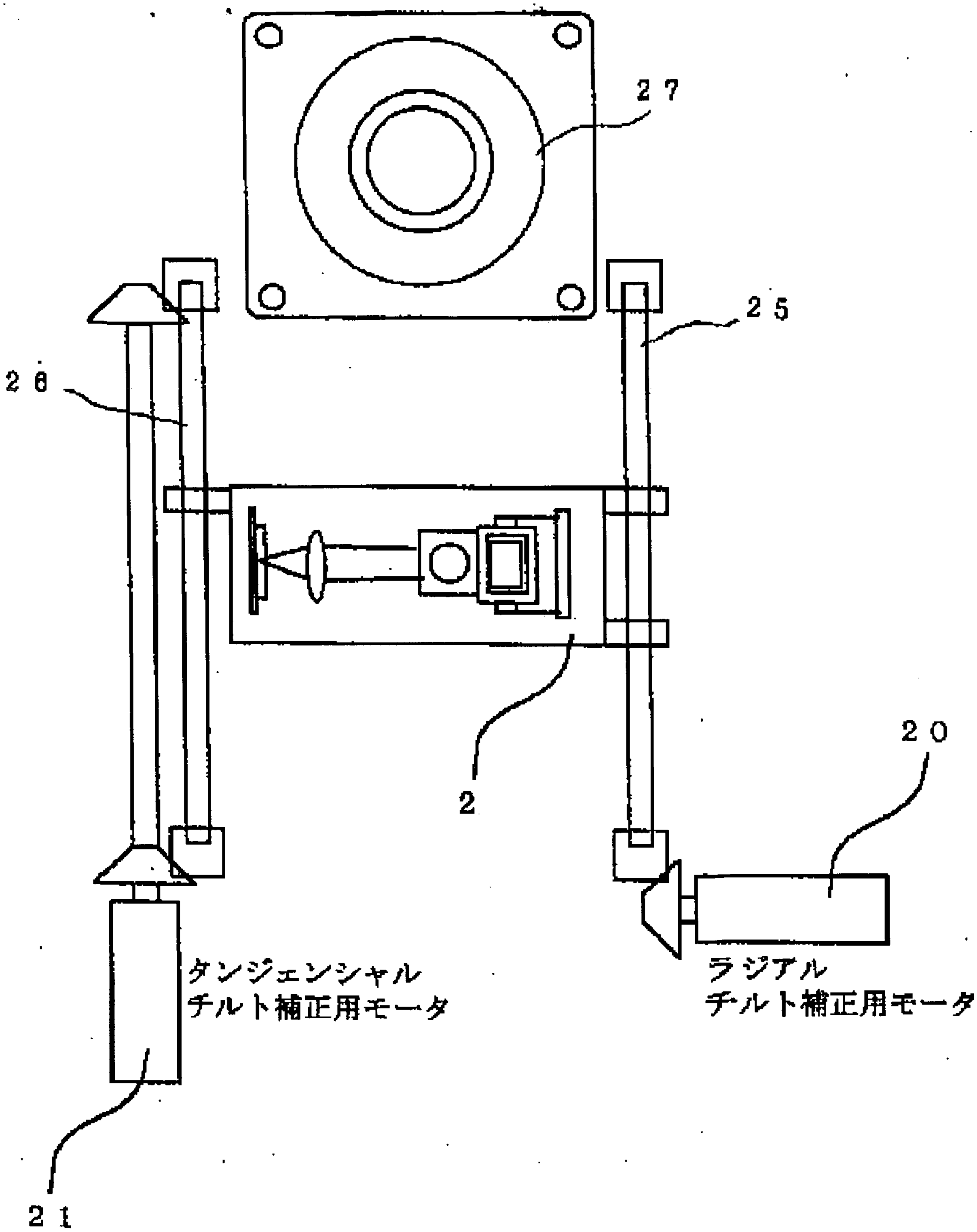

1 面ぶれディスク
7
FG
TrDrv
FoDrv
DSP
2
6
ディテクタ
5
3
CPU
A, B,
C, D,
E, F
11
FE
TE
RFAmp
4
チルト
補正機構
ジッター
検出回路
RF
8
10
DATA
CLK
EQ回路
PLL回路
9
チルト
制御回路
12

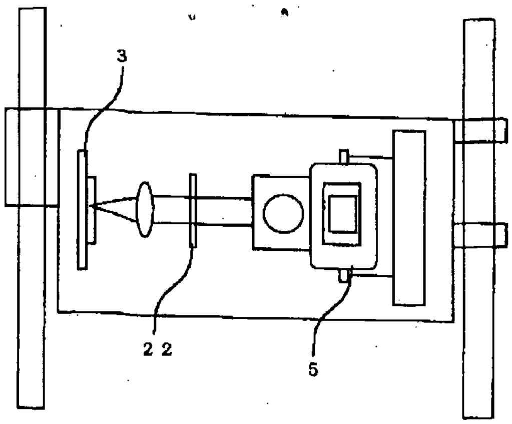

開始
Bestjit=FFFFh
BestRtGain=Oh
RtGain=StartBtGain
…Step1
RtGainでのジッター値
jit（RtGain）測定
…Step2
jit(RtGain)>=Bestjit
jit(RtGain)<Bestjit
…Step3
Bestjit=jit(RtGain)
BestRtGain=RtGain
…Step4
RtGain=RtGain+α
…Step5
RtGain<=EndRtGain
…Step6
RtGain>EndRtGain
RtGain=BestRtGain
…Step7

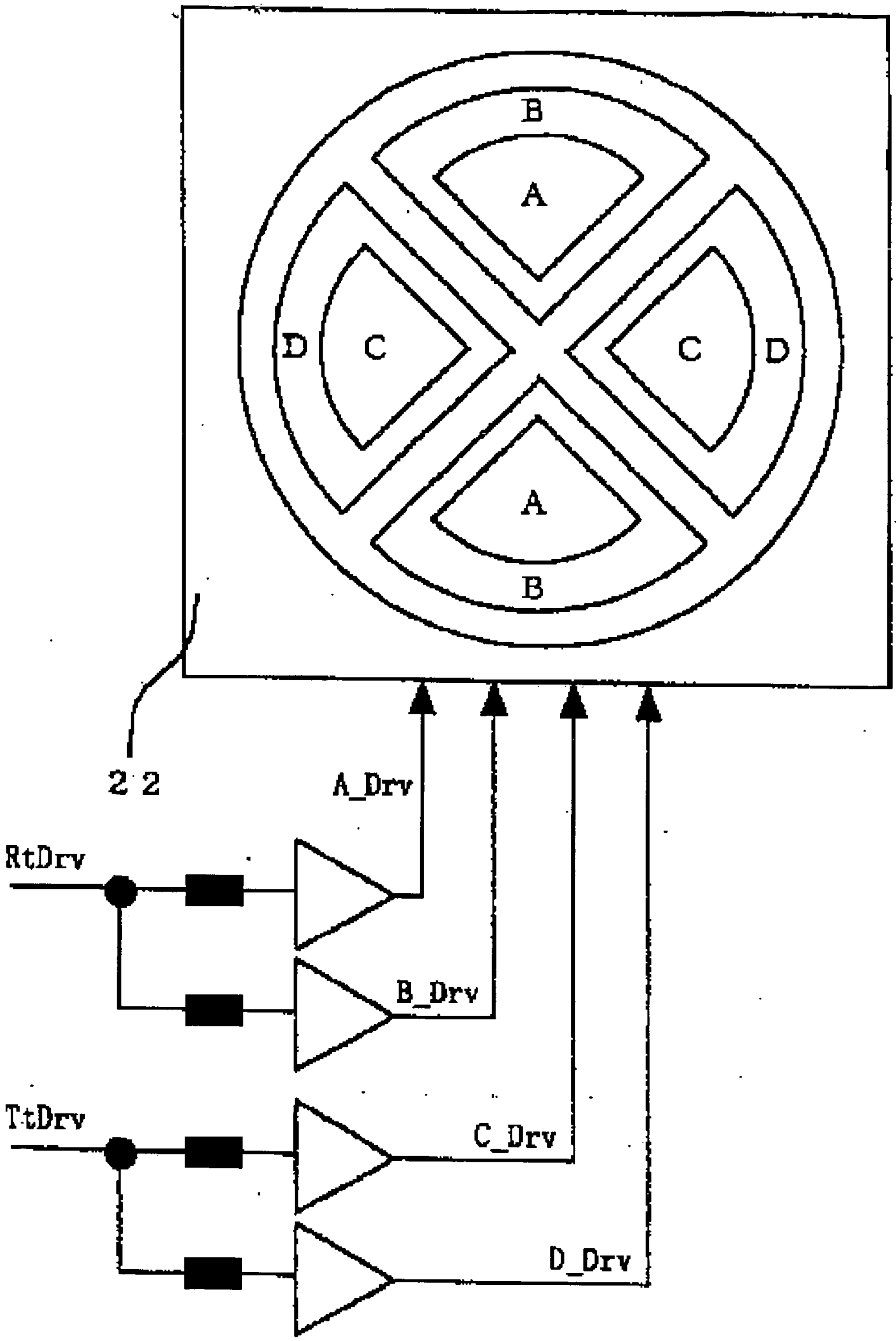

開始
Bestjit=FFFFh
BestTtGain=Oh
BtGain=StartTtGain
…Step11
TtGainでのジッター値
jit（TtGain）測定
…Step12
jit(TtGain)＞=Bestjit
…Step13
jit(TtGain)＜Bestjit
Bestjit=jit(TtGain)
BestTtGain=TtGain
…Step14
TtGain=TtGain+β
…Step15
TtGain＜=EndTtGain
…Step16
TtGain＞EndTtGain
TtGain=BestTtGain
…Step17

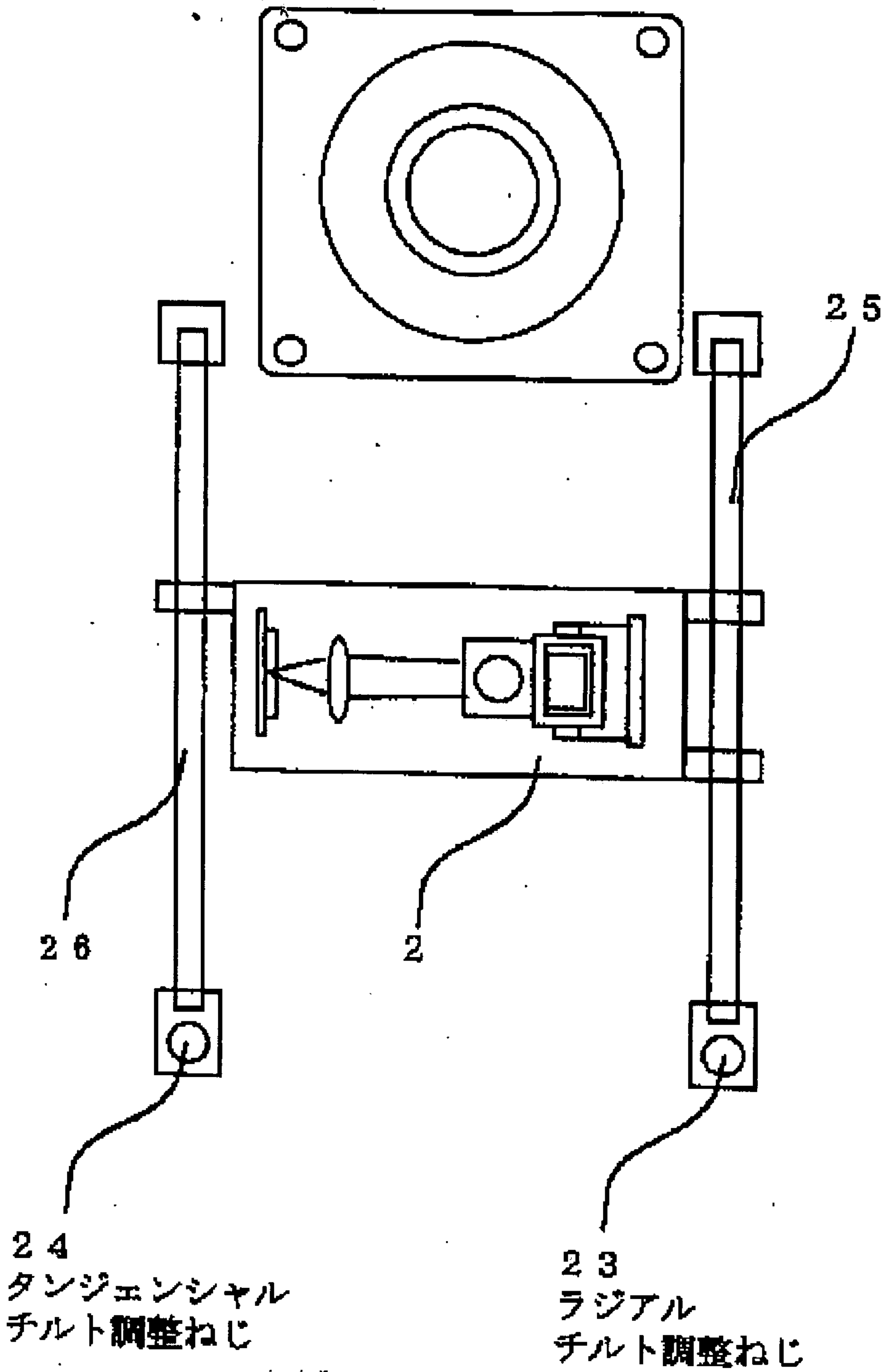

2 0
ラジアル
チルト補正用モータ
2 7
2 1
タンジェンシャル
チルト補正用モータ
2


2 0
RtDrv
M
ラジアル
チルト補正モータ
TtDrv
M
タンジェンシャル
チルト補正モータ
2 1


27
25
26
2
20
タンジェンシャル
チルト補正用モータ
ラジアル
チルト補正用モータ
21


3
2 2
5


B
A
D
C
C
D
A
B
2 2
A_Drv
RtDrv
B_Drv
TtDrv
C_Drv
D_Drv


２５
２６
２
２４
タンジェンシャル
チルト調整ねじ
２３
ラジアル
チルト調整ねじ